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PROCEEDINGS

OF THE

AMERICAN ACADEMY

OF

ARTS AND SCIENCES.

VOL. V.

FROM MAY, 1860, TO MAY, 1862.

SELECTED FROM THE RECORDS.

BOSTON AND CAMBRIDGE:
WELCH, BIGELOW, AND COMPANY.
1862.

Hist. 17/2

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PROCEEDINGS

OF THE

AMERICAN ACADEMY

OF

ARTS AND SCIENCES.

SELECTED FROM THE RECORDS.

VOL. V.

Four hundred and eighty-fourth meeting.

May 29, 1860. — ANNUAL MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters acknowledging the reception of the Academy's publications; also from the Entomological Society of Stettin, and the Royal University of Christiana, Norway, accompanying donations to the library. Also, a letter from Theodore Lyman, Esq., Fellow of the Academy, presenting a copy of the *Histoire et Mémoires de l'Académie des Inscriptions*, Vols. 1 to 50, inclusive, and Index, and fourteen volumes of the *Mémoires de l'Institût*, complete to the year 1818.

The thanks of the Academy were voted to Mr. Lyman for his valuable donation.

The Treasurer presented his annual report upon the finances of the Academy; which was ordered to be entered in full upon the record-book.

Professor Rogers reported, from the Committee on the Library, that 236 volumes and 416 parts of volumes have been added to the library by gift during the past year, and 213 volumes and 268 pamphlets by purchase. Also, that 723 volumes have been borrowed from the library during the year.

Professor Lovering read the report of the Committee on Publication, detailing its operations during the past year.

In behalf of the Council, Professor Gray, its secretary, read the following report upon the changes which have occurred in the *personelle* of the Academy since the preceding annual meeting: —

Since the last annual meeting, the Academy has elected six Resident Fellows, three Associate Fellows, and two Foreign Honorary Members.

Three of the newly chosen Fellows belong to the First Class; one to the Second; and two to the Third Class.

Of the Associate Fellows, one was chosen into each Class.

Of the Foreign Honorary Members, one, M. LIOUVILLE of Paris, belongs to the First Class, Section 1: the other, Professor VALENTIN, to the Second Class, Section 3.

These accessions exactly equal the number of vacancies which have been caused by death during the past year.

Within this period, five Resident Fellows have deceased; viz. HON. THOMAS G. CARY, HON. RUFUS CHOATE, REV. DR. WILLARD, MR. BENJAMIN A. GOULD, MR. WILLIAM WELLS, — all of Class III.

We have lost three Associate Fellows; viz. THOMAS NUTTALL, of the Second Class; HORACE MANN, and WASHINGTON IRVING, of the Third Class.

Also, three Foreign Honorary Members; viz. ROBERT STEPHENSON, of Class I.; KARL RITTER, of Class II.; and FREDERICK WILLIAM THIERSCH, of Class III.

The anniversary meeting offers a fitting occasion for some tribute, however cursory, to the memory of the Associates whose death we have to deplore. For important assistance in the preparation of these obituary remarks, the Council offer their acknowledgments and thanks to several Fellows, who kindly responded to their call, and of whose help they would gladly have availed themselves more largely. But our statements upon the present occasion must needs be brief and general.

Indeed, two of our late Associates, CHOATE and IRVING, were men whose mark and fame render all comment, which could be offered here and now, superfluous. Prompt and fitting public eulogies have already been elsewhere pronounced over the remains of the most eloquent advocate of our time; and, still more recently, over those of the popular author, who down to the close of a long and most honorable life continued to adorn, by important works, that American literature to the formation and general recognition of which he had, even in early years, contributed more than any other writer.

The earliest loss from our immediate ranks was that of the HON. THOMAS GRAVES CARY, which followed within a month our last anniversary. Mr. Cary was born at Chelsea in 1791; was graduated at Harvard College in 1811, and admitted to the Suffolk bar in 1814. After a residence of several years in Brattleborough, Vermont, in the practice of his profession, and afterwards in New York, where he engaged in commerce, he returned to Boston, where he passed the rest of his useful and honorable life in various business pursuits, and in the occupation of many important trusts. He died on the 3d of July last. Mr. Cary was a man of refined literary taste, a lover of art, and a careful student of moral, political, and economical science. His numerous published articles, lectures, and reviews upon these subjects, and his more elaborate Memoir of Thomas Handasyd Perkins, show him to have been a vigorous writer and speaker, in a pure and idiomatic style. His sterling integrity and good sense, and unaffected dignified manners, his active interest in educational and social questions, and his efficient administration as President for many years of the Boston Athenæum, and in other responsible trusts, are well remembered by his associates in this and in other institutions.

REV. SAMUEL WILLARD, D. D., was born at Petersham, Mass., on the 19th of April, 1776, was graduated at Harvard College in 1803, became Assistant Preceptor in Exeter Academy in 1804, and a Tutor in Bowdoin College the following year. He was ordained over the Unitarian Church in Deerfield, Mass., in 1807, elected a Fellow of the Academy in 1816, resigned his pastoral charge on account of loss of sight in the autumn of 1829, and died at Deerfield on the 8th of October, 1859. These few data indicate all the principal epochs of an uneventful, but a valuable and useful life. They suggest no title to celebrity; but they present a modest and valid claim to that respect which justly attaches to intelligence, virtue, and piety, and to a faithful and exemplary devotion to his sacred calling. His publications were few; but they are creditable to his learning, good sense, and Christian temper. Among them is a collection of hymns, many of which were of his own composing, and prepared with reference to an original theory, which is elaborately explained in the Preface. During the thirty years of his total blindness, his memory, which was naturally good, was cultivated, as is not unusual in such cases, to great quickness and accuracy. Besides retaining with literal exactness nearly the whole of the New Testament, he is said to have solved all the problems of Euclid, orally, by recalling the images of the diagrams with which he had been familiar in his youth.

Our late respected colleague, **BENJAMIN APTHORP GOULD**, also died in October last. Mr. Gould was born in Lancaster, Mass., in 1787, and graduated at Harvard College in 1814. In early life he struggled against many disadvantages, having only the opportunities of a common country school, and not having even the command of his own time until he became of age. He then supported himself by teaching for some years, a profession in which he exhibited peculiar aptitude and acquired a marked reputation. Being intent on a collegiate education, he prepared himself, somewhat late in life, for admission into College, almost without assistance, and afterwards took his place in the foremost rank of a class distinguished by the presence of some of our brightest luminaries in literature. In the latter part of his Senior year, a vacancy occurred in the Public Latin School in Boston, and Mr. Gould, though yet an undergraduate, received, in consequence of the character he had acquired and the strong recommendations of President Kirkland and others, the appointment of master in that institution. How well he discharged the duties of that office the testimony of his numerous pupils, and the acknowledged elevation of the character of the seminary itself, afford ample proof. In 1828, Mr. Gould resigned his post as Principal of the Latin School, and devoted the remainder of his life to commerce. For many years he sustained the reputation of an honorable, intelligent, and successful merchant; and has died in the maturity of life, leaving many who recollect with pleasure his generous nature, his conscientious rectitude, and his unwavering fidelity in the path of duty.

Even within the past month, viz. on the 21st of April, the Academy lost another, and one of its most venerable Fellows, **MR. WILLIAM WELLS** of Cambridge. Mr. Wells had reached nearly the age of eighty-seven years, — an age which had of late precluded him from any active participation in our labors, — and his retirement had made him comparatively a stranger to most of our members. Yet those who were privileged to know him can truly say, that to the last his lively sympathy still followed with interest the literary and scientific movements of the day. Mr. Wells was endowed by nature with that exquisite taste which avoids in life, as in literature, all tints that do not blend and harmonize. No surer critic could be found of any work of genius, classical or modern; no safer arbiter of the appropriate and the true in social intercourse. His conversation was singularly fascinating, and it would be prized just in proportion as study and refinement had qualified the hearer to appreciate his highly cultivated intellect. To these mental endowments, to sound scholarship and fine taste and critical power, were added in Mr. Wells a most attractive sweetness and simplicity of character.

Of our two late Associate Fellows deceased during the past year, one, MR. NUTTALL, was personally known only to some of the older Fellows of the Academy, and perhaps mostly to those interested in Natural History. The other, MR. MANN, moved in a wider and more public sphere, and was too prominent and active in educational, reformatory, and political life not to attract a large measure of attention.

HORACE MANN was born in Franklin, Norfolk County, Mass., May 4, 1796. His early life was one of toil and sorrow. His father died in 1809, and he remained with his mother on the farm until 1816, when, after a hurried preparation by an itinerant teacher, he entered the Sophomore Class in Brown University, Providence, R. I., where he was graduated with the highest honors in 1819. After a few months spent in reading law, he was appointed to a tutorship in Latin and Greek at Brown University. He resigned this post in 1821, and was admitted to the bar in December, 1823; and immediately opened an office in Dedham, where he continued in the practice of law until 1833. In 1827 he was elected to the General Court, and annually re-elected until 1833, when he removed to Boston. From that time until 1837, he was a member of the State Senate, continuing also in the practice of his profession. He then became first Secretary of the Massachusetts Board of Education, and for twelve years was indefatigable in those labors which have given him an enduring fame. In the spring of 1848, he was chosen to succeed John Quincy Adams in the National House of Representatives, re-elected in November, 1848, and again in November, 1850. In September, 1852, he was elected President of Antioch College, at Yellow Springs, Ohio, which was opened in October, 1853, and over which he presided to the day of his death, which occurred on the second day of August, 1859. The distinguishing traits of his character were his unwavering fidelity to his convictions, and the passionate intensity with which he gave himself to the work before him. He usually had some chosen great end in view, to accomplish which he labored with a zeal and energy of which few, even of the strongest men, are capable. The Asylum at Worcester is perhaps the noblest of the monuments which attest his efficiency when a member of the State Legislature; the great and sudden improvement of the common schools in Massachusetts shows that his oft-quoted and oft-praised reports give no exaggerated view of his ability and success as Secretary of the Board of Education; the feelings which, after a lapse of eight years, are awakened in Massachusetts by any allusion to his course in Congress, bear conclusive testimony to his intense devotion, while there, to the single cause for which he took a seat in the House; and the voice of his pupils at Antioch College assures us, that, for the last six years of his life, he gave himself up wholly to the interests of his charge. Abstemious and economical in his habits, he was generous to those who needed his aid; full of tender affections, and repressing them only for fear that they should lead him to be too lenient to wrong-doers. So great was his scorn of all vice, and so unflinching his exposure of moral weakness, that few knew how deep and loving was his heart. His chief fault arose from that which was his highest virtue. Careful to attempt only what he thought he ought to do, he considered success to be a duty, and threw himself upon his work with such an intense energy as to render him incapable, for the time, of seeing the possibility of any other course, or any other opinion. But this want of breadth was atoned for by the superior effectiveness which it gave him in behalf of whatever he undertook.

THOMAS NUTTALL was born of humble parents at Settle, in the West Riding of Yorkshire, in the year 1786, and died at Nutgrove, (an estate in Lancashire bequeathed to him by his uncle,) on the 10th of September last. Although his life began and closed in England, nearly his whole scientific career belonged to this country, and was devoted to American Natural History. When he immigrated to the United States in 1808, at the age of twenty-two years, he no doubt brought with him a fondness for the pursuits in which he afterwards excelled; but his knowledge was acquired here, mostly in the field, and through his own explorations. His extended explorations began, within two years after his arrival in this country, with a journey up the Missouri River, in company with Mr. Bradbury, — a journey at that day perilous; and it was with much suffering and danger that the small party penetrated to some distance beyond the Mandan villages, where they were robbed by the Indians and narrowly escaped with their lives.

Between 1811, when he returned to Philadelphia, and 1817 Mr. Nuttall had visited the more accessible portions of the United States; and in 1818 he published his "Genera of North American Plants," — his largest, and, considering the period and the circumstances of its production, much the best of his botanical works.

The next year his equally perilous journey up the Arkansas River and its tributaries was undertaken, the principal results of which were published in his "Narrative of a Journey into the Interior of Arkansas," with an Appendix full of interesting scientific and ethnological information; and in several separate botanical memoirs.

After the death of Professor Peck, in 1822, Mr. Nuttall was called to supply his place at Cambridge, which he did for ten years; during which he produced his admirable "Manual of the Ornithology of the United States and Canada," as well as several botanical, ornithological, and mineralogical papers. Leaving Cambridge in the winter of 1833 – 4, he made a third and more successful attempt to penetrate and explore the western part of the continent, then so imperfectly known. Joined to Captain Wyeth's party, he crossed the Rocky Mountains by the pass at the South Fork of the Platte, reached the coast of Oregon, visited the Sandwich Islands, and the coast of California in the vicinity of San Francisco, Monterey, and San Diego, and returned to Boston by a voyage around Cape Horn.

The scientific results of this exploration, and of some other collections, so far as they have been published or elaborated by Mr. Nuttall himself, are contained in three memoirs in the Transactions of the American Philosophical Society, in the first volume of Torrey and Gray's Flora of North America, and in Nuttall's three volumes supplementary to Michaux's North American Sylva.

In 1842 the death and legacy of his uncle recalled Mr. Nuttall to England, to an estate upon which he resided, with the exception of a visit to the United States in the autumn and winter of 1846 – 7, until his death, in September last, at the age of seventy-three.

Mr. Nuttall was a person of great simplicity of life and manners, and of extremely retiring habits, though affable and communicative when with congenial companions. Although fond of every department of Natural History, and a proficient in ornithology and mineralogy, to our knowledge of which he made useful contributions, his favorite pursuit was Botany. His earliest and principal work, the Genera of North American Plants, revealed talents for observation and description of a high order, and a quickness in detecting natural affinities which seemed to be intuitive, and was certainly very remarkable for that day. Altogether, the name of Nuttall must ever stand very high among the pioneers of botanical science in the United States.

The three names which now disappear from the roll of our Foreign Honorary Members, belonged one to each of our three Classes. They are those of the great Engineer, the great Geographer, and of one of the most distinguished Greek scholars of the age.

STEPHENSON died in October last, in middle age; RITTER, on the 28th of September, in his eighty-first year; THIERSCH, near the end of February, in his seventy-seventh year.

ROBERT STEPHENSON was the son, pupil, and companion of the illustrious George Stephenson,— a man to whose genius, persevering industry, and practical good sense our age is more indebted for its greatest instrument of civilization and material progress, than to the talents or labors of any other individual. Inheriting a good measure of his father's mental endowments, and judiciously trained in the physical and mathematical sciences, by which his talents were developed, strengthened, and directed, without being smothered or distorted by an excess of mere learning, our associate opened upon his career, as assistant to his father in building the Liverpool and Manchester railway, and in perfecting the locomotive which triumphed over all its competitors in 1829. The completion of this road and engine established the fact that railways were to become the greatest instrument of intercourse amongst men, and were to carry the power of civilization wherever the dry land appeared.

On the formation of the London and Birmingham company for the commencement of the road which was to become the central line of England, Mr. Stephenson, although hardly thirty years old, received the appointment of Chief Engineer, when he soon established a reputation second only to that of his father; and on the gradual retirement and subsequent death of the latter, he became, in public estimation, though not without rivals, the first railway engineer in Europe.

This is not the time nor the place to review his controversies with some of his rivals, who, with more ambition than genius, attempted to surpass his constructions, and those of his father, by mere excess of dimensions, — for which they received from many persons a praise which should be accorded only to improvements of mechanical construction or organization. It is enough upon this subject to say, that the experience of the few years that have yet elapsed has shown, as far as so short an experience can show, that upon all these subjects of controversy Mr. Stephenson was mainly in the right; nor has it yet appeared that in his long and diversified career he ever made what may be called an engineering blunder. Praise like this can hardly be accorded to any one who has gone before him.

Of all the works of Mr. Stephenson, the tubular bridge, of which the first was constructed to cross the Menai Strait, is that upon which his reputation for genius will mainly rest. In the construction of the railway and locomotive, no high claim as an inventor can be accorded to him, for not only his father, but Trevethick and many others had preceded him; but the tubular bridge is the embodiment of a high original conception, at once bold and practical; and although it will probably never be of common use, yet there have been and must hereafter occur extraordinary obstacles, which cannot be so well overcome in any other way.

Our colleague was fortunate, not only in his paternity, but in his time; — a time when the wealth of a long peace and the activity of a great empire were lavishly poured out under an excessive, perhaps morbid, excitement for railway improvements. This, added to the great aid derived from the recent improvements in all the useful arts, gave him a success that no genius or activity at any preceding time could have brought to his career, — a career that posterity will not fail to recognize as having left a deep impression upon our age.

Frederick William Thiersch, one of the most distinguished philologists of the age, was born at Kitscheidungen near Freyburg, June 17, 1784. His early education was pursued in the schools of his native town; he studied afterwards at the Universities of Leipsic and Göttingen, and took his doctor's degree at Göttingen in 1808, immediately after which he was appointed Professor in the Lyceum of that place. In the following year (1809) he was called to Munich as

Professor in the University just established there. The condition of the country was such, on account of the military movements of the time, that young Thiersch was only able to reach his destination in safety by joining a French corps, and marching equipped like a common soldier. He found that learning in Bavaria was at a very low ebb, and he at once devoted himself to the promotion of education and literature with extraordinary zeal and ability. It was through his influence over the most enlightened men of the kingdom that classical studies, including the archæology of art, first assumed the prominent position which they maintain at the present day in the Bavarian capital. In 1812, he founded the Philological Seminary, which soon became an important part of the University, and in the same year commenced the publication of the *Acta Philologicorum Monacensium.* Thiersch took a lively interest in the fortunes of Greece, and was one of the first among the European scholars to predict the restoration of her nationality. In 1814 he went to Vienna, and, meeting Count Capo d'Istria there, assisted in founding a Greek society of the friends of literature (the φιλόμουσσι), and afterwards the political society intended to embrace the leading Greeks wherever found, and called the *Hetæria.* When the war of independence broke out, in 1821, his zeal in the cause influenced the king and court of Bavaria to lend their aid to the establishment of the Greek nation. In this and other ways he proved himself to be a constant and most valuable friend to the Greeks. Soon after the close of the war he visited the country, and made a careful study of its actual condition. The results of his observations were given to the world in 1833, in a work written in French, and entitled *L'Etat actuel de la Grèce;* and it is to him more than to any other, that Prince Otho was indebted for his election to the throne of Greece. The other writings of Professor Thiersch are on Public Education, on Ancient Art, editions of the Greek Classics, and numerous contributions to the transactions of the Royal Bavarian Society of Sciences, of which he was President for several years. In 1858 the jubilee of Mr. Thiersch's doctorate was celebrated with great enthusiasm at Munich. Deputations from all the leading Universities of Germany, and from numerous learned societies, were sent to Munich with addresses and congratulations. Orders of knighthood were conferred upon him by German sovereigns and by the king of Greece, in token of their high estimation of his character, abilities, and learning. The young Greeks studying in the University of Munich sent to him a lyrical poem in the ancient language of their country, written by Bernadahes, one of their number, who has since distinguished himself in poetical literature, and the University of Athens addressed to him a grateful letter, written in Classical Greek by Professor Philippos Johannis, one of the most accomplished teachers, and in that year the *Prytanis* or Rector of the University. Professor Thiersch, it is understood, has left an edition of Æschylus, which he had prepared with a view to its publication after his death.

By his decease the world has lost a scholar of large and various acquirements, a man of elevated principles and pure character, of amiable temper and cordial manners, an acute and tasteful critic in literature and art, an author whose works take rank among the most learned productions of the age, a friend and supporter of learned institutions and of liberal principles of government.

Carl Ritter, the renowned author of the *Erdkunde*, &c., — or "The Science of the Globe in its Relation to Nature and to the History of Mankind," was born in Quedlinburg, a town of Prussian Saxony, on the 7th of August, 1779. When he had passed only two years as a student at the University of Halle, he became, for eighteen years, a private tutor in the family of Mr. Hollweg, a wealthy banker of Frankfort, where the celebrated statesman and minister, Von Bethmann-Hollweg, was one of his pupils. In 1814, after prolonged travel in the middle and south of Europe, he brought his two pupils to the University of Göttingen, where he produced, in 1817 and 1818, the first and second volumes of the first edition of his great geographical work. Two years after, mainly through the instrumentality of William Humboldt, then Minister of Public Instruction, he was called to Berlin, as Professor of Geography at the Royal Military School and at the University, — where the first chair, it is believed, devoted to that special branch of knowledge in any German university, was created for him.

Here, besides other writings, he published, in 1822, the first volume of a second and much enlarged edition of his *Erdkunde*. This — after ten years of intense academical activity, largely occupied by the preparation and delivery of the courses of public lectures which gave him such renown as a teacher — was followed in 1832 by a second volume; and from that time down to 1838, six more volumes, or one volume a year, attest his wonderful industry and learning. In the twenty-one succeeding years, that is, to the close of Ritter's life, eleven volumes more, or one volume every other year, tell of his ceaseless activity, notwithstanding his advancing age. The first volume was devoted to Africa; the nineteenth, which nearly finishes Asia, was published only a few weeks before his death.

Ritter's personal qualities and character — as one of our colleagues, once his favorite pupil, informs us — were exceedingly attractive and admirable. The same competent judge, himself a distinguished cultivator of geographical science, pronounces that "the peculiar turn of Ritter's mind was more intuitive than logical, more synthetical than analytical, more objective than subjective. . . . . . While, therefore, his views and his method are entirely original, we seek in vain in his works for a formal system, an absolute idea rigorously carried out. His unflinching loyalty to the truth, as he sees it, not as he infers it may be, seems to render such systematization uncongenial to his mind. He shrinks, indeed, from all cold and formal definitions. Even his most characteristic conceptions, those which constitute the spirit of his method, preserve much of the nature of deep intuitions, — the expression of which is always highly suggestive, but often lacks the clear, logical shape which make them easy to define, and would give them immediate currency. With a mind essentially constructive, he descends, nevertheless, with the most scrupulous care into the study of details; and it is upon the well-secured basis of facts alone, and with a sense of the true sometimes almost amounting to divination, that he builds up his broadest generalizations. It may be inferred, accordingly, that Ritter possessed in a high degree that noble endowment of the greatest students of nature, that plastic imagination which gives the power to keep before the mind true and vivid conceptions of natural objects, whether in their isolation or in combination, as in one great picture, — so obtaining deeper insight into their whole relations than any mere analytical process could ever afford."

The fundamental idea of Ritter's whole geographical writings — still to use the language of our colleague, with some condensation — is "a strong belief that our globe, like the totality of creation, is a great organism, the work of an All-wise Intelligence, — an admirable structure, all the parts of which are purposely shaped and arranged, and mutually dependent, and by the will of the Maker fulfil, like organs, specific functions, which combine themselves into a common life. But with Ritter this organism of the globe comprises not only nature, but man, and with man, the moral and intellectual life. Old as is this idea of the Cosmos as applied to the physical world, it was Ritter's merit to have made a special and most happy application of it to geographical studies. No one before him had perceived so clearly the hidden but strong ties which mutually bind man and nature, the close relations between man and his dwelling-place, between a continent and its inhabitants,—influences which stamp races and nations each with a character of their own. Considered under this aspect, every portion of our globe, stamped by nature with a peculiar character, assumes new meaning and importance. As the body is made for the soul, so, upon this view, is the physical globe made for mankind."

What the *Philosophy of History* is in the field of human society, such, with the physical world for its subject, is the *Philosophy of Geography;* and of this new science, Carl Ritter may be said to have been the founder.

As to the present *personelle* of the Academy, the Council report,—that

The actual number of Resident Fellows is		155
Of which the First Class contains	47	
the Second Class "	48	
the Third Class "	60	

The Associate Fellows are 78 in number.

Of these, Class I. contains	33
" II. "	29
" III. "	16

The Foreign Honorary Members are 70 in number.

Of these, Class I. contains	26
" II. "	26
" III. "	18

They are distributed in sections as follows:—

CLASS I.

Section 1.	Mathematics	9	members.
" 2.	Practical Astronomy and Geodesy .	6	"
" 3.	Physics and Chemistry	8	"
" 4.	Technology and Engineering . .	3	"

Class II.

Section 1.	Geology, Mineralogy, &c.	6	members.
" 2.	Botany	7	"
" 3.	Zoölogy and Physiology	8	"
" 4.	Medicine and Surgery	5	"

Class III.

Section 1.	Philosophy and Jurisprudence	4	members.
" 2.	Philology and Archæology	8	"
" 3.	Political Economy and History	4	"
" 4.	Literature and the Fine Arts	2	"

Finally, the Council made nominations of several distinguished persons to be chosen Foreign Honorary Members and Associate Fellows.

On motion of the Vice-President, it was voted that the Chairman of the Rumford Committee be authorized and directed to reclaim the possession of the die of the Rumford medal, now deposited at the United States Mint, Philadelphia, and to place it in the safe of the Academy.

Appropriations were voted, — On motion of the Treasurer, of twelve hundred dollars for general expenses during the current year;

On motion of the chairman of the Committee on Publications, of fourteen hundred dollars for printing the Academy's publications;

On motion of the chairman of the Library Committee, of eight hundred dollars for the purchase of books and other expenses of the library.

The annual election was held, and the following officers were chosen for the ensuing year: —

Jacob Bigelow, *President.*
Daniel Treadwell, *Vice-President.*
Asa Gray, *Corresponding Secretary.*
S. L. Abbot, *Recording Secretary.*
J. P. Cooke, *Librarian.*
Edward Wigglesworth, *Treasurer.*

Council.

J. I. Bowditch,
Joseph Lovering, } of Class I.
E. N. Horsford,
Louis Agassiz,
Jeffries Wyman, } of Class II.
J. B. S. Jackson,
James Walker,
Henry W. Torrey, } of Class III.
Robert C. Winthrop,

The Standing Committees, nominated by the President, were elected as follows: —

Rumford Committee.

Eben N. Horsford,
Joseph Lovering,
Daniel Treadwell,
Henry L. Eustis,
Morrill Wyman.

Committee of Publication.

Joseph Lovering,
Jeffries Wyman,
Cornelius C. Felton.

Committee on the Library.

A. A. Gould,
W. B. Rogers,
George P. Bond.

Committee to Audit the Treasurer's Accounts.

Thomas T. Bouve,
C. E. Ware.

Committee of Finance.

Jacob Bigelow,
Edward Wigglesworth, } *ex officio*, by statute.
J. I. Bowditch, by appointment.

Professor C. W. Eliot presented a memoir by F. H. Storer and himself on the Impurities of Commercial Zinc, with special reference to the residue insoluble in dilute acids, to Sulphur, and to Arsenic.

The Corresponding Secretary presented, from the authors, the following paper: —

Description of two new Genera and eight new Species of Fossil Crinoidea, from the Rocks of Indiana and Kentucky. By S. A. Casseday and S. S. Lyon.

DICHOCRINUS, *Münster.*

In a *résumé* of this genus by MM. De Koninck and Le Hon, they state that, up to the appearance of their work,* only three species of this genus had been described; they add six, which, together with eleven described by American geologists, make in all twenty species. This comprises all the species of which we have any personal knowledge.

Heretofore much uncertainty has existed as regards the number and disposition of the radials and the arms. De Koninck and Le Hon give the following formula: —

Basal pieces	2	
Radial pieces	4 × 5	
Inter-radials		Unknown.
Anal piece	1	Known.
Arms	10	

Dr. B. F. Shumard, in some remarks about this genus, states as follows: — "The anatomical structure of a very perfect specimen of this genus corresponds only in part with the above formula. In our fossil we find a base of two pieces, supporting a circle of five large radials and one large anal piece, as in all known species of this genus. The radials however, are not repeated, but each one immediately gives rise to two brachial pieces, which are pentagonal, and in turn support, each, two simple arms; so that the number of the latter amounts to twenty."†

The Messrs. Austin, who up to this time have figured the most perfect examples of the genus, represent the number of radial pieces to be twenty, i. e. "five repeated four times."

"In *D. ovatus* there appear to be but ten, i. e. five repeated twice;

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* *Recherches sur les Crinoides.*

† Trans. Acad. St. Louis, Vol. I. No. 1, p. 71.

while in *D. cornigerus* and *D. sexlobatus*, now described for the first time, the whole number of radials is only five."

In a number of well-preserved individuals of *D. polydactylus*, we have always found three radials, and on examination of other species we have concluded this to be the number most frequently met with. The following list contains all the species of Dichocrinus which show in a satisfactory manner all the radial pieces.

D. cornigerus	1 × 5
D. ficus	3 × 6
D. fusiformis	3 × 5 *
D. ovatus	3 × 5
D. polydactylus	3 × 5

D. simplex also will doubtless show three radial pieces when perfect examples are found; *D. cornigerus* differs from other species in having two brachials coming immediately from the primary radial. This is the only species showing satisfactorily such an arrangement. Shumard quotes, above, *D. ovatus* as having two radials repeated five times, yet in his description of the species (Owen and Shumard, Geol. Survey of Iowa, &c., p. 590) he says, "Several joints of the arms remain attached to one of the superior plates, in the *only specimen* we have been able to procure. The first joint is of a rectangular form, and supports a cuneiform joint, on the bevelled edges of which is the commencement of the two series of smaller plates." The formula for the radial pieces will be, —

Radial pieces . . . . 1 to 3 × 5.

Arms. But few specimens have been figured preserving the arms. They generally come off in five pairs, often bifurcating below, until they attain even to the number of forty divisions, as in *D. polydactylus*. *D. fusiformis* has ten arms (five pairs) without bifurcations. *D. ovatus* has, most probably, the same number. *D. polydactylus*, as we have said above, has with the bifurcations 8 × 5 = 40. *D. cornigerus* which differs considerably from all other species, has 4 × 5 = 20. *D. ficus* has six pairs, 6 × 2 = 12, again bifurcating on the first joint, producing twenty-four arms or fingers. We may readily suppose that the greater number of the species of this genus have five pairs of arms, bifurcating once or more. The arms are long, fimbriated, and composed of cuneiform pieces, either in single or double rows.

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* Austin (Monograph of Crinoideæ, pl. 5, fig. 6, c) figures a single ray as having three small radials above the large primary radial. His specimen (pl. 5, fig. 6, b) is very imperfect, and we think it highly improbable that four radials exist in the individual there figured; such a mistake is more easily made than mistaking *Dichocrinus elongatus* for a *Platycrinus*. *Hexacrinus macrostatus* of the same authors has all the appearance of a *Dichocrinus*. (*loc. cit.*, pl. 6, fig. 3, a.) J. Müller in his paper (Über neue Echinodermen des Eifeler Kalkes, pl. 1, fig 3) figures a fossil which bears a most remarkable resemblance to a *Dichocrinus*; he calls it *Hexacrinus*.

Inter-radials. Shumard is the only author who notices inter-radials. He says, that "from four to five exist in two of his species, they rest on the oblique superior lateral edges of the radial plates." They might easily be mistaken for the lower pieces of the vault.

We propose, then, the following formula for *Dichocrinus*: —

Basal pieces	2
Radial pieces . . .	1 to 3 × 5
Inter-radial pieces . . .	4 to 5 × 5
Anal pieces	1 to 5
Arms	5 pairs, bifurcating.

Columns round.

The vault, in all the specimens where we have seen it preserved, is large, high, and more or less ornamented with thorns and salient tubercles. This genus differs so markedly from the genera *Platycrinus* and *Hexacrinus*, both in the more elongated form, the bipartite basis, and its deep angular notch on the anal side, that it admits of an easy distinction. It approaches quite nearly to *Cotyledonocrinus* and *Pterotocrinus*, having like them a bipartite base, with a series of large pieces about it. *Cotyledonocrinus* has only five pieces arising from the basis, instead of six, the arms are non-bifurcate; the difference between this genus and *Pterotocrinus* is so marked that they cannot be confounded.

DICHOCRINUS POLYDACTYLUS, *Sp. Nov.*

Body. Subconoidal, resembling the ornate capitals of some composite columns, spreading rapidly from the base, the upper portion marked by prominent folds of salient tubercles. The whole of the pieces of the calyx are thin.

Vault. Surmounted by a large proboscis: column small, subrotund.

Basal pieces. The two basal pieces are large, spreading rapidly from a small base, similar in size, obscurely heptagonal; at the terminations of the diameter opposite from the one which makes the suture line they are prolonged into quite acute angles, forming the two obscure angles of the heptagon. Immediately above the columnar pit, or a very little below it, is a series of massive tubercles irregularly disposed, and varying in size, the remainder of the bases being comparatively smooth. From the margin of the columnar pit extend, in the direction of the arms, four raised folds, two on each piece, ornamented by several tubercles and striæ.

Radials. The first are very large, pentagonal, trapezoidal in shape, their upper facets being much wider than the lower ones. They extend out as far as the first or second pieces beyond the axillary radials; the middle portions are swollen out into folds or plaits; their junction with the second radials is distinguished by a large tuberous knob, beneath which are one or two smaller ones. A number of striæ regularly disposed, and a few minute granules are scattered over the surface of the pieces. This raised median line of the radial pieces produces broad intervalla between each two of them. The second and third radial pieces are very minute; the second join the first radials at the knobby prominence described above; the third are axillary, and give off two rays each.

Inter-radials. One large inter-radial is placed between each pair of arms.

Anal piece. At one termination of the articulating facet of the basal piece (the other being at the anterior radial piece) is situated a single anal piece. It is not so wide as the radials, but of the same length, pentagonal; as in the radials, its centre is elevated, it differs from them in the portion where the second radials join the first; on the radials there is a well-defined, articulating facet, whilst on the anal piece none exists, the piece being solid and continuous throughout.

Vault. We have no specimen showing the vault; in one example before us, there is a proboscis much crushed and misshapen; it is large, composed of many small, coarse, tubercular pieces, and extends not quite one third the length of the arms. Its terminal point is apparently formed by two circles of pieces surrounding a single one.

Arms. From each third radial come off two arms. They are about three times as long as the body, and arranged as follows: in each arm six quite stout quadrangular pieces, rounded on the dorsal surface, are superimposed upon each other; the sixth are axillary, each give off two slender fingers, which are composed of the following pieces: first, one or two quadrangular ones, upon them from five to seven somewhat smaller wedge-formed ones placed one above another, the large end of one wedge being placed over the small end of the next, the wedges becoming gradually more acute, until on the sixth or seventh piece there commences a double row of small, quite acute, pentangular pieces, which alternate with each other, the salient edges of one row fitting into the retreating angles of the other row, the points of their junction being lateral, not central, as in most other genera having similar arms. Yet two more fingers exist on each arm; they are situated on the outer surfaces of the six pieces described above (the first one on the second piece from the last radial, the second one on the fourth piece from the same radial), the inner surfaces having no branches, and lying close together throughout their whole extension. They spring apparently from the sides of the pieces, the facets being on the sides, rather than on the top as in a regular axillary piece; curving out gracefully for a short distance, they continue in a straight line to their ends without any further bifurcation. They are slender, composed of pieces exactly similar to those of the fingers already described. On either side of the ambulacral grooves of the fingers is a row of stout pinnulæ.

Dimensions: —

Height of calyx to insertion of arms	.55	inch.
Diameter at the arms	.85	"
Height of basal pieces	.26	"
Length of arms	2.00	"
Length of proboscis (variable proportion in diff. sp.)	.60	"

Geological Position and Locality. Rare in the silicious mud beds at the top of the Knob member of the subcarboniferous limestone, Hardin County, Kentucky; Montgomery County, Indiana, &c.

DICHOCRINUS SYMMETRICUS, *Sp. Nov.*

Body. The general form of the body is subconical; from the basis to the summit of the first radials it is basin-formed, above which it contracts upward and terminates in a point, formed by the large spinous piece which surmounts the vault.

The *basal pieces*, two in number, are of equal size, pentagonal; line of junction with each other straight, forming when united an irregularly-sided octagon. The columnar pit is shallow, oval; columnar facet obscurely pentagonal; perforation small and round. The pieces are prominent near the line marking their junction to those resting upon them, being suddenly reflected upward.

Radial pieces five, subquadrangular, the largest as wide as high, diminishing in size from the anterior piece on either side to the anal piece, swelling from the base and sides toward the superior margin, irregularly truncated above, slightly depressed at the summit between the pieces.

Second radials. Fragments of the second radials are attached to some of the first radial pieces; they are minute, and rise within the superior margin of the first radial pieces. The precise form of the second radials is not known.

Inter-radials. Between each group of arms, resting in the depression between the radials, is a single piece, usually pentagonal in form; it rises nearly as high as the opening into the body at the arms.

Anal pieces. Rising from the deepest angular notch at the junction of the basal pieces, is a large piece, the lower part of which is similar in form to the first radials, rising higher than they do; the upper margin is horizontally truncated about one third the breadth of the piece; the sides above the radials angularly sloping toward the top of the radials on either side; the centre of this piece supports one, and the sloping sides each support a piece of the second range of anal pieces; those on the sides correspond in size, form, and position, to the inter-radial pieces above described. These are again succeeded by a third range of pieces, triangular in form, three in number, the central one of which reaches the mouth (?), which is surrounded by three additional, small, long, narrow pieces. The series of pieces under the mouth are slightly depressed above the second range.

Summit. The summit above the radials recedes a considerable distance within the upper margin of the calyx. It is covered by numerous small polymorphous pieces, six of which are spinigerous; the largest and most prominent of these occupies the centre of the summit, immediately in contact with the pieces surrounding the mouth; the other pieces forming the second series of those rising above the openings into the body at the arms. The two spinous pieces above the arm-pieces of the postero-lateral rays form a circle around the central piece, the anterior part of the summit having one more range of pieces above the arms than above those arms on either side of the anal field. Beneath each of the small spinous pieces above the arms is a pentangular piece, the inferior margins of which are prolonged into an acute angle, separating the openings into the body into two equal parts, the upper portion of these pieces supporting the spinous pieces above the arms, the lateral upper portion supporting a piece on either side: these last pieces are prolonged downward, and curved around the outer sides of the arm openings, the outer margins of those touching each other form a closed ring, with the piece between them around the summit, except on the anal side. The lower margins are supported on either side by the upper margin of the inter-radial pieces. On the anal side are two additional pieces, nearly square, resting between the last pieces above described and the spinous pieces, and the pieces described above as anal pieces.

Arms. The openings into the body are five pairs; the arms are in all, probably, ten in number: their form is unknown.

Column. Unknown. We are indebted to Professor J. M. Safford, of Tennessee, for the beautiful specimen figured in his report.

Dimensions: —

Greatest diameter of basis	.25	inch.
Least " "	.20	"
Vertical height of calyx	.20	"
Length of first radials	.20	"
Height of specimen	.55	"
Greatest diameter of calyx	.45	"

Geological Position and Locality. Rare in the upper beds of the cavernous member of the subcarboniferous limestone, in Breckinridge, Grayson, Edmondson, Hart, and Warren Counties, Kentucky. Vertical range, so far as at present known, about sixty-five feet, reaching from the base of the first sandstone of the millstone-grit beds to the first white bed beneath.

DICHOCRINUS ELEGANS, *Sp. Nov.*

Body. Viewed from above the outline of the summit is stellate; the deep grooves between the arms and the anal side would produce a sinuous stellate figure in any section above the calyx. The calyx is somewhat basin-shaped, but it is much more erect than in *D. symmetricus.* The rounded form of the first radials is continued to the top of the second piece above the arms, dividing the body into five prominent ridges.

Basal pieces two, of the same form and size, prominent; a broad, shallow, elliptical depression surrounds the column: columnar pit small and shallow, the line marking the junction of the pieces straight.

Radial pieces five, obscurely hexagonal, about as broad as high, rising suddenly from the lines marking the lateral margins of the pieces; the upper corners truncated, thus forming an angular depression between the pieces for the reception of the inter-radial pieces.

The *second radials* appear to have been quite small, and to have stood prominently forward upon the summit of the first radial pieces; the facets by which they were attached to the first radials are all that remains of them; further their form and arrangement are unknown.

Inter-radials. The inter-radials are quite small, lozenge-shaped; they each support two interbrachial pieces of similar form.

Anal pieces. The first anal piece rests in the deepest angular notch in the basis, rising considerably higher than the first radials; like them it is hexagonal; upon it rests a small hexagonal piece; this in turn supports upon its upper margin a pentagonal piece, the upper part of which is elongated, and reaches to the oral (?) opening. Between the first and second anal pieces, also between the second and last piece described, rests, on either side, one small, lozenge-shaped piece, the lowest forming one side of the circle about the arm openings, the upper pair supporting small, pointed pieces lying above the arms on either side of the anal field.

Summit. The summit is covered by numerous small pieces, as in *D. symmetricus.* A spinigerous piece rises in each group above the arms; the pieces surrounding the mouth are quite small, angular, the apex of the angle toward the oral opening; they are about six in number, and form a slight elevation upon the otherwise plane summit, the oral opening being above the general level of the top of the vault, the level part being covered by about ten polymorphous pieces. The condition of our specimen is such that the arrangement of the pieces surrounding the arm orifices cannot be satisfactorily made out; the pieces appear to be more numerous than in *D. symmetricus*, and the arms seem to have come off from the body in sets of four; making twenty arms at the body.

Arms. The form of the arms unknown.

Column. Unknown.

Dimensions: —

Greatest diameter of the basis	.20 inch.
Least " " "	.15 "
Height of the first radials	.15 "
Greatest width of radials	.15 "
Height of specimen	.40 "
Greatest diameter.	.42 "
Least diameter	.32 "

Geological Position and Locality. This elegant little crinoid is quite abundant near the top of the cavernous beds of the subcarboniferous limestone, Edmondson County, near the Mammoth Cave. Good specimens are rare. The vertical range of this species, so far as ascertained, is about thirty-eight feet.

Remarks. *D. elegans* is nearly allied to *D. symmetricus* and several undetermined species; it will readily be distinguished from *D. symmetricus* by its more erect figure, the absence of the strong spinous central piece at the summit, by the greater prominence of the arms, as well as the larger number at the body, and the consequent greater number of small pieces making up the clusters about the arm facets.

DICHOCRINUS FICUS, *Sp. Nov.*

Body. Subovoid, inflated near the centre of the length of the first radial pieces, from which it contracts toward the summit of the calyx; contracting regularly toward the column, around which it is inflated. Columnar pit small, slightly depressed.

Basal pieces two, similar in form and size, obscurely pentagonal; dividing line straight; the summit of the pieces united present five slightly curved depressions, and one angular notch for the reception of the radial and anal pieces.

Radial pieces, first series five, similar in form and size, a little higher than wide, subquadrangular; the upper margin slightly indented near the middle for the reception of the radials of the second series. *Radial pieces, second series,* five, minute, semicircular, buried in the indentation at the summit of the first radials. *Radial pieces, third series,* small, depressed, cuneiform, axillary; the oblique upper margins of each support two arms.

Anal piece, — one, similar in form and size to the first radial pieces; like them it bears a second and third radial, and a pair of arms.

Arms. Twelve, composed of rather long, quadrangular pieces, rising from the third radial piece and bifurcating on the second piece above it. Only two ossicula above the bifurcation are preserved on our specimen. The arms are slender.

Vault. Our specimens do not show the vault. It is unknown.

Column. Small, near the body, composed of thin pieces of equal size and thickness; the edges are rounded.

Dimensions: —

Height of calyx	.45 inch.
Greatest diameter	.30 "
Diameter at base of the arms	.25 "
Height of radials	.22 "

Geological position and locality: Rare, in beds at the top of the sandy mud beds at the base of the subcarboniferous limestone, Clear Creek, Hardin County, Kentucky; Montgomery County, Indiana, &c.

DICHOCRINUS SCULPTUS, *Sp. Nov.*

Body. Short, conical, regularly expanding from the column to the summit of the first radials; the basals and first radials are elaborately ornamented by prominent irregular carinæ, which generally lie nearly parallel to the vertical sides of the pieces.

Basal pieces. Two; similar in form and size, pentagonal; dividing line straight; columnar facet large, prominent, expanded, producing a rim around the column and the margin of the calyx. The joined basal pieces have four curved and two angular depressions at the summit; the deepest and largest of the latter marks the anal side.

Primary radials: first series five; subquadrangular, one third higher than wide, inflated at the junction with the second radials, which rise from a depression in their upper margin. The *radials of the second and third series* (?) are absent; their form is unknown.

Anal piece. One; similar in form and arrangement to the radials of the first series.

Arms. The form and number of arms are unknown.

Column. Unknown.

Dimensions: —

Height of calyx	.27 inch.
Diameter at summit of first radials	.30 "
Diameter of inflation at the insertion of the column	.10 "

Geological position and locality. A single specimen of the calyx was obtained from the first limestone above the base of the millstone-grit beds, in Hardin County, Kentucky.

Remarks. The ornature of this beautiful crinoid will distinguish this from all other known species.

COTYLEDONOCRINUS, *Nov. Gen.*

Generic formula: —

Basal pieces, . . 2.
Radial pieces, . . 3 × 5; first large and long; second minute; third small, axillary.
Secondary radial pieces, 2 × 10.
Arms, ... 10; long, ciliated.
Inter-radial pieces, . 3 × 5; small.
Mouth subcentral.
Summit covered by many polymorphous pieces.
Column round, small, formed of alternate large and small thin pieces.
Radial pieces all arm-bearing.
Anal piece none.

COTYLEDONOCRINUS PENTALOBUS, *Sp. Nov.*

Body. When the arms are absent the body is a long ovoid figure; the summit contracting rapidly, while the lower portion of the calyx, as high as the top of the basal pieces, is rather more elongated. The base is rounded, and intumescent about the column. The two *basal pieces*, when united, form a conical cup about as deep as wide, having four slight concave depressions on its upper margin, and one angular notch. The junction of the basals rises between the concave depressions, dividing them into pairs, the angular notch being equally taken from the pieces on either side of the line dividing them. Columnar pit small, the presence of the column in our specimens concealing its depth; it is probably quite shallow.

The *first primary radials* are large, more than twice as high as wide, a little wider in the middle of the length of the pieces than at the ends. The *second* and *third* primary radials are buried in an excavation at the summit of the first radials. There is no gibbosity or swelling at the insertion of the second radials; the first radials appear to run under them perfectly smooth.

Second primary radials five; they are very minute, lunette-formed, less than a semicircle, slightly depressed at their upper margin.

Third primary radials, five; small, leaf-like, resting upon the second radials, spreading beyond them, the outer margin expanding upward. The centre of the pieces is prolonged upward into a little tongue-like figure; on either outer margin is also a prolongation about half as wide as the centre one, and of nearly equal height, leaving a deep, square-like notch on each side of the centre prolongation of the pieces.

First secondary radials. These pieces are ten in number, two to each third primary radial; they are similar in form and size, about as high as wide, fitting into the indentations on either side of the third primary; they rise a little over one third of their height above the centre prolongation of the primary to which they are joined, are truncated obliquely downward and outward from their junction with each other; the outer margins falling into, and further expanding, the somewhat circular outline of the second and third primary radials.

Second secondary radials. Ten in number, resting on the bevelled upper margins of the pieces below them, nearly as high as wide, deeply indented for the reception of the first brachial pieces, thus divided into three tongue-like points, not unlike the centre point of the third primary, and two oblong circular depressions; each division of the upper margin of the pieces occupying about one fifth of its length; they are joined together by a straight line continuous with that marking the junction of the pieces immediately below them.

Arms. Twenty, delicate, three times as long as the calyx, each ray supporting four; they are non-bifurcate, composed of about six thin, irregular, oblong pieces above the first brachial, where they are composed of a double row of very thin pieces, joined in the centre of the arms by angular points, which fit into the alternate depressions on either side, the junction forming a serrated line; each of the pieces forming the double row composing the arms bears a long filamentous cilia, which is composed of very minute pieces, the length of which is about equal to their diameter.

Inter-radial pieces. Between each group of four arms, and rising in the notch between the first radials, are three, sometimes four, small inter-radial pieces; the first is pentangular, widest below the centre of the inferior margin, angular, the superior margin a horizontal line;

upon this are disposed the other pieces, one above the other, rapidly diminishing to a point.

Summit. The summit is divided into five fields; the division line appears to radiate from the centre of the summit to the centre of each group of arms. Four of these fields are nearly alike; the form and the arrangement of the pieces in each are similar; the fifth field, which lies above the junction of the basal pieces, between the pairs of circular depressions, supports a short rudimentary proboscis near its centre, about .01 of an inch in diameter, and about .15 of an inch in height, composed of a great number of small pieces (seventy to eighty). The pieces covering the fields are of irregular size, the general form inclining to triangular; some are quadrangular, one end of the piece being much narrower than the other; other pieces are elongated octagons.

Column. The column is round, delicate, composed of very thin pieces, the alternate ones larger and smaller; near the calyx the column suddenly enlarges to its insertion into the columnar pit.

No surface markings are visible.

Dimensions: —

Height of basal pieces	.20	inch.
" " first radial pieces	.40	"
" " second and third together	.03	"
Diameter of calyx	.45	"
Length of arms	1.00	"
Diameter of column	.02	"

Geological position and locality. Rare, in the third limestone above the base of the millstone-grit beds of Grayson Springs, Grayson County. Its vertical range appears to be quite limited.

Remarks. This elegant little crinoid is closely allied to *Dichocrinus* and *Pterotocrinus;* it differs from both genera in the number of pieces forming the series resting on the basal pieces. The deepest angular notch in the basis of both genera usually marks the anal side; in our genus the mouth is on the field, on the side directly opposite the only angular notch in the basis. All the pieces rising from the basals bear arms in our genus; but this is also true of DICHOCRINUS FICUS, which has six arm-bearing pieces, and no barren or non-arm-bearing piece, termed anal piece in this genus.

As genera and species are now defined, we are compelled to separate our genus from *Dichocrinus.* When these interesting animals have been further investigated, it is probable that a better classification may be introduced.

ALLOPROSALLOCRINUS, *Nov. Gen.*

Generic formula: —
Basal pieces, . . 3.
Radial pieces, . 2 × 5.
Secondary radial pieces, 2 × 5.
Anal pieces, . . 3 to 4, or more.
Inter-radials, . . 1 × 4.
Arms, . . . 11 to 13 ; variable, form unkown.
Column, small (?) ; form unknown.
Vault covered with numerous polygonal pieces.
Mouth proboscidiform.

ALLOPROSALLOCRINUS CONICUS, *Sp. Nov.*

Body conical; calyx plane or slightly saucer-shaped, columnar pit excavate, involving the basals and part of the pieces which close the circle around them.

Basal pieces three, two of which are much larger than the third, irregularly pentagonal.

Radial pieces. The first radials, five in number, are large, hexagonal, differing considerably in size; three rise upon the summit of the basal pieces, and two rest in the notches between them. The *second radial* pieces are pentagonal, axillary, differing in size and form, each of the two upper oblique margins supporting one of the *secondary radial* pieces; these, ten in number, vary in size and form; triangular, quadrangular, and pentangular pieces being all found in a single individual. These in turn support another series of pieces of the secondary radials, larger than the other pieces of the ray, twice as broad as high, subquadrangular, thick, indented by a deep sinus upon the upper margin. One of the postero-lateral rays, and sometimes both, have an additional secondary radial, in which case it is similar to the first secondary radials.

Arms. The arms vary in number; the regular rays support each two arms, and the postero-lateral ray to the left of the anal field supports three; making eleven arms. Sometimes both postero-lateral rays have three, and then the number is twelve. In some specimens, the ray to the left of the anal field supports four arms, and that on the right of it three; when this is the case, the arms are thirteen in number. The arm facet is large and nearly circular, and, as before stated, deeply grooved in the upper part; the piece of the vault which rests upon the arm pieces is also indented, the opening into the body being partly in these and partly in the arm pieces. The last pieces of the secondary radials form a closed ring around the calyx, except on the anal side.

Inter-radial pieces four, one to each field; they are the largest pieces forming the calyx, longer than wide, septagonal or hexagonal; they rise between the first radials, and reach the last secondary radials.

Anal pieces usually four; the first is hexagonal and rests on the basal pieces, its summit is truncated and supports the fourth anal piece, its oblique margins support two pieces, one on either side, nearly equal in size, pentagonal or obscurely hexagonal: the fourth piece is long, lanceolate, and extends between the pieces which support the arms, reaching to the vault.

Vault. The vault or summit is covered by rather large, polygonal pieces, interspersed amongst which are a few quite small ones. All the pieces covering the vault are prominent, and inflated in the centre.

Mouth nearly central. The form of the proboscis is unknown; it is broken from all the specimens which have come under our observation. The whole character of this species is coarse and robust.

Column. Unknown.

The *calyx* is covered by minute granular markings.

Dimensions: —

Height of calyx	.10 inch.
Greatest diameter of calyx	1.25 "
Height of specimen	1.05 "
Diameter of joined basal pieces	.25 "
Diameter of arm facets	.25 "

Geological position and locality. Rather abundant in sandy mud-beds at the top of the Knob-member of the subcarboniferous limestone, Clear Creek, Hardin County; also near Scottville, Allen County, Kentucky, &c.

ALLOPROSALLOCRINUS DEPRESSUS, *Sp. Nov.*

The general arrangement of the pieces of the calyx differs but little from *A. conicus*. There are, however, several distinguishing characteristics, rendering it necessary to separate it from that species.

A. depressus is always unsymmetrical, the mouth being subcentral and placed nearest to the anterior side. The postero-lateral rays always bear three arms each. The summit is always depressed or inclined to the anterior side, and the columnar pit is more angular than in *A. conicus*.

Dimensions :—

Greatest diameter	1.05 inch.
Least diameter	.85 "
Height (proboscis broken off)	.42 "

Geological position and locality. Found in considerable numbers near the top of the silicious mud-beds of the subcarboniferous limestone, Clear Creek, Hardin County, Kentucky.

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Four hundred and eighty-fifth meeting.

August 8, 1860. — STATED MEETING.

The PRESIDENT in the chair.

A quorum for the transaction of business not being present, only scientific communications were in order.

The Corresponding Secretary communicated two papers, entitled as follows: —

"A List of the Phænogamous Species of a Botanical Collection made in the Eastern Part of Cuba by Charles Wright, in the years 1856, 1857, and 1859 – 60, with characters of the New Genera and Species: Part I. The Polypetalæ and Apetalæ, by Professor A. Grisebach, of the University of Göttingen."

"Determinations of the Ferns of the same collection, also of Fendler's Venezuelan Collection, by Daniel C. Eaton, of New York."

Dr. C. T. Jackson read and commented on a letter received by him from M. Moissent, of the Imperial School of Mines, Paris, giving an account of a new gas-engine, invented by M. Lenoir of that city. He also gave some further details concerning the frozen well, at Brandon, Vermont.

Four hundred and eighty-sixth meeting.

September 11, 1860. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Horsford, chairman of the Rumford Committee, laid upon the table the dies for the Rumford medal, received from the United States Mint, in pursuance of a vote of the Academy at the last Anniversary Meeting. And they were deposited in the iron safe of the Academy.

Professor Horsford submitted a memoir on the relations of the salts of zinc and alumina to those of soda and potassa.

Messrs. Charles W. Eliot and Frank H. Storer presented the two following notes, supplementary to their Memoir upon the Impurities of Commercial Zinc.

I. *On the Amounts of Lead contained in some Silver Coins.*

From our experiments upon the impurities of commercial zinc,* we found that this metal almost invariably contains lead. In the preparation of silver at the United States Mint, zinc is used for the purpose of reducing chloride of silver,† and a sample of zinc similar to that used at the Mint, which we examined, yielded half of one per cent of lead. The question naturally suggested itself whether lead might not thus find its way into American silver coin, and to determine this point we have analyzed several American coins, as specified in the following table; for the sake of comparison we subsequently examined the other coins therein enumerated.

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* Memoirs of the American Academy, 1860 [N. S.], VIII. 57.

† Booth and Morfit's Smithsonian Report on Recent Improvements in the Chemical Arts, (Washington, 1851,) p. 56. Compare Wilson's Report on the New York Industrial Exhibition, in Dingler's Polyt. Journal, 1855, CXXXV. 119.

TABLE.

(1.) Kind of Coin.	(2.) Weight of Coin taken. Grammes.	(3.) Weight of BaO, SO_3 found. Grammes.	(4.) Weight of Pb corresponding to SO_3 in the BaO, SO_3 of column (3).	(5.) Corresponding per cent of Lead in the Coin.	(a.)* Weight of PbO, SO_3 found. Grammes.	(b.)* Corresponding weight of Pb.	(c.)* Corresponding per cent of Lead in the Coin.
1 American half-dollar of 1824.	13.2936	0.0465	0.0412	0.3100	0.0480	0.0327	0.2462
20 American five-cent pieces of 1853.	24.2630	0.0571	0.0507	0.2090	0.0555	0.0379	0.1560
10 American five-cent pieces of 1854.	12.1980	0.0314	0.0278	0.2282	0.0270	0.0185	0.1513
2 American twenty-five-cent pieces of 1858.	12.4097	0.0322	0.0286	0.2305	0.0310	0.0273	0.2200
"Fine silver"† from the U. S. Assay Office in New York, 1860.	30.6405	0.0557	0.0494	0.1611	0.0655	0.0447	0.1457
1 Spanish dollar of 1793. Carolus IV.	27.0130	0.0170	0.0151	0.0558	0.0129	0.0088	0.0326
1 Mexican dollar of 1829.	27.2265	0.0127	0.0118	0.0434	.....	.....	.....
2 English shillings of 1816.	10.4597	0.0537	0.0507	0.4847	0.0590	0.0422	0.3846
1 French five-franc piece of 1852. Napoleon III.	24.9725	0.1135	0.1069	0.4282	0.1296	0.0886	0.3546

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* Columns (a), (b), and (c) contain the results of a supplementary series of experiments, made merely to control the results given in columns (4) and (5). (*Vid. infra.*)

† The solution of this fine silver in nitric acid became blue when neutralized with ammonia. The filtrate from the mixed precipitate of sulphate of lead and gold (see p. 56) contained a decided trace of copper and a fainter trace of iron. The solution of sulphate of soda, from which the sulphuric acid of col. (3) was

On the supposition that the zinc used in the reduction of the silver is the source of the lead in the American coin, it is easy to calculate the amount of lead which would thus find its way into the coin, since the quantity of zinc used in reducing a given weight of silver, and the per cent of lead which that zinc may be expected to contain, are both known quantities. Professor Booth * says that an excess of zinc is required to insure total and rapid reduction, and Wilson † states, that two equivalents of zinc are used, in practice, for each equivalent of silver. Our memoir, already cited, gives the per cents of lead found in two specimens of Vieille Montagne zinc. The standard of the American silver coin is $\frac{9}{10}$ silver and $\frac{1}{10}$ copper, and the weight of fifty cents' worth of this alloy, in either half-dimes, dimes, quarters, or a half-dollar, has been 192 grains = 12.433 grammes, since the year 1853.‡

Fine silver in the half-dollar, . . .	11.190 gram.
Zinc used in reducing 11.19 gram. silver, .	6.742 "
Amount of lead in 6.742 gram. zinc, if the zinc contains 0.292 per cent of lead, § . .	0.0197 "
Amount of lead in 6.742 gram. zinc, if the zinc contains 0.494 per cent of lead, § . . .	0.0333 "

If zinc of the best quality (containing 0.292 per cent. of lead) had been used, the silver coin would have contained 0.158 per cent of lead; if the second quality (containing 0.494 per cent of lead) has been employed, the coin may contain 0.268 per cent of lead. Between these two limits all our determinations of lead in American silver will be found to lie.

In offering this explanation of the occurrence of lead in American silver coin, we would by no means affirm that the zinc is the exclusive source of this impurity, for it is not at all improbable that a portion of the lead is derived from the leaden vats in which the reduction of the

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determined, exhibited a slightly yellowish-light-brown color, nothing similar to which occurred in any of the other experiments. A slight black residue remained when this silver was dissolved in nitric acid, and a trace of gold was detected in the residue described on p. 59.

* *Loc. cit.*

† *Loc. cit.*

‡ Brightly's Dig. Laws U. S., for Standard, Title *Coinage*, § 3; for Weights, Title *Coinage*, § 13.

§ See our Memoir in Mem. Amer. Acad. [N. S.], VIII. 61, Table I.

chloride of silver is effected, or from the sulphuric acid which is used to excite the reaction.

The method of analysis employed was as follows. The coin having been dissolved in moderately strong, pure, nitric acid, the cooled solution was treated with an excess of a solution of pure caustic ammonia, added by small portions, — no notice being taken of the small, dark-colored residue (AgS, etc.) insoluble in nitric acid. The precipitated oxide of silver was re-dissolved in nitric acid, enough of the latter being added to render the solution distinctly acid. The whole was then heated in a water-bath, and a strong solution of pure chloride of ammonium added, until chloride of silver was no longer precipitated, care being taken to avoid adding an unnecessary excess of chloride of ammonium. It will be seen, that the chloride of silver was thus precipitated in presence of a large excess of nitrate of ammonia; and since chloride of lead is readily soluble in a solution of nitrate of ammonia,* any lead which the coin may have contained would remain in solution. It may be mentioned in passing, that the small amount of chloride of silver which, as has already been stated by Mulder,† is retained in solution by nitrate of ammonia, — especially by hot solutions, — did not interfere in the least with the subsequent steps of the analysis, or in any way to influence the amount of lead obtained. The precipitated chloride of silver was collected upon a filter, and thoroughly washed with hot water, the lumps of chloride of silver being broken down as much as possible with a glass rod. The filtrate and wash waters were evaporated in a porcelain dish to the consistence of a thin syrup, and then transferred to a flask of hard German glass, in which the evaporation was continued until the nitrate of ammonia had been entirely destroyed. This operation requires care in the application of the heat, lest violent decomposition of the nitrate of ammonia ensue, and portions of the substance be projected from the flask. When properly conducted, the process goes on tranquilly, and no loss occurs. The residue, consisting of nitrate of copper, together with nitrate of lead, and more or less gold, should be washed with hot water into a porcelain dish, where it is mixed with a slight excess of pure sulphuric acid. It may be necessary to use a little nitric acid to dissolve the last portions of the substance in the flask. The mixture is then evaporated over the water-bath until it has become almost entirely dry, — or until it no longer exhibits any tendency to effervesce; it is then somewhat more strongly heated on a sand-bath, until all the free sulphuric acid has been driven off, that is, until fumes of sulphuric acid are no longer perceptible. The necessity of thoroughly evaporating this mixture cannot be too strongly insisted upon, for a solution of gold in sulphuric acid * is formed when the mixed nitrates, etc. are treated with sulphuric acid, and unless this compound be entirely destroyed by heating, it will be subsequently decomposed when water is added, and give rise to a precipitate of metallic gold, in a condition so finely divided that it cannot be separated by filtering. The occurrence of this precipitate would ruin the analysis. We at first sought to prevent the formation of this solution of gold in sulphuric acid, by heating very strongly the residue left in the flask after all the nitrate of ammonia had been decomposed, until the escape of nitrous fumes had entirely ceased, and the nitrate of copper was decomposed. We then treated the mass with pure dilute nitric acid, and filtered off the solution from the gold which had been deposited and from any chloride of silver which had been dissolved by the nitrate of ammonia, with the intention of determining the lead directly, by precipitating it as sulphate from this solution after evaporation with sulphuric acid. It was found, however, that a large portion of the gold-salt escaped decomposition in the flask, the yellow solution of sulphate of gold being formed almost as abundantly after this treatment as when the flask was not heated so strongly; and since in this method there is great risk of fracturing the vessel from drops of acid condensing in its neck and flowing down upon the hot portion, it can in no wise be recommended. A perfectly dry mixture of sulphate of copper, sulphate of lead, and metallic gold having been obtained, it is treated with distilled water, — a considerable quantity of the latter being added at once, and the mixture quickly stirred to prevent the sulphate of copper from forming a hard cake as it becomes hydrated. As soon as the sulphate of copper is completely dissolved, a small quantity of pure sulphuric acid is to be added to the solution, and the latter set aside for at least forty-eight hours. The precipitate, consisting of sulphate of lead and metallic gold, was then collected upon a small Swedish filter and washed, first with dilute sulphuric acid to remove the sulphate of cop-

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* Bolley, Ann. Ch. u. Pharm., 1854, XCI. 115.

† Die Silber-Probirmethode, (Leipzig, 1859,) p. 28.

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* Compare Pelletier, Ann. Ch. et Phys. [2], XV. 12.

per, and subsequently with alcohol, until no trace of free sulphuric acid remained. After drying, the precipitate of sulphate of lead and gold, with the filter cut into small pieces, was transferred to a beaker glass, and the whole was then digested with pure bicarbonate of soda * (prepared from the oxalate), during at least forty-eight hours. The sulphate of soda formed by this operation was then filtered off from the carbonate of lead and metallic gold, and the amount of sulphuric acid which it contained determined by precipitation with chloride of barium in the usual way. From the amounts of sulphate of baryta thus obtained, recorded in column (3) of the table, the amounts of lead (col. 4) in the mixed precipitates of sulphate of lead and gold were calculated.

The carbonate of lead, mixed with bits of paper and gold, above mentioned, was now dissolved in dilute nitric acid, the solution evaporated with sulphuric acid until all the nitric acid had been expelled, subsequently treated with water acidified with sulphuric acid, and, after standing for forty-eight hours, collected upon a tared filter, washed with dilute sulphuric acid and alcohol, dried at 100°, and weighed. The results may be found in column (a) of the table.

The re-agents used in the foregoing operations were all chemically pure. A special experiment was moreover made, in which portions of the nitric acid, ammonia, chloride of ammonium, and sulphuric acid used, twice as large as any which were actually employed in the analysis of either of our samples of coin, were evaporated together, and subjected to a course of treatment identical with that which the solutions of coin were forced to undergo; but not a trace of sulphate of lead, or of any precipitate, other than a few light and utterly insignificant floating flocks, probably alumina, could be detected as the result of this trial.

That our process is sufficiently accurate to exhibit *all* the lead which the samples of coin examined really contained, we do not think probable. All of the sources of error to which the process, when properly conducted, is subject, tend to cause a slight loss of lead. Thus, in the first place, it is scarcely possible that the last traces of chloride of lead can be removed by washing from the caseous precipitate of chloride of silver,* which precipitate is in enormous mass as compared with the amount of chloride of lead; and again, the first precipitate of sulphate of lead, mixed with gold, which is obtained after evaporation with sulphuric acid, occurs in so finely divided a state, that it is exceedingly difficult to prevent loss by the passing of a portion of it through the pores of the filter upon which the precipitate is collected. To one unused to the process, it might seem as if the last traces of sulphuric acid could hardly be removed from this precipitate by washing with alcohol. We have satisfied ourselves, however, that this is easily effected, and that this seeming source of error is, in reality, entirely insignificant; at any rate, the results given in columns (a), (b), and (c) are in no way influenced by this imaginary error. It may not be amiss to observe, that we have been particularly scrupulous with regard to the treatment of the above-mentioned precipitate, having in every instance continued to wash it with alcohol long after any reaction of sulphuric acid could be detected. It should also here be stated, that the results in which we ourselves place the most confidence are those obtained by determining the amount of sulphuric acid in the mixed precipitate of sulphate of lead and gold (see cols. (3), (4), and (5) of the table), for columns (a), (b), and (c) contain the results of a secondary process liable to all the accumulated errors of a long series of operations; moreover, the final precipitate of sulphate of lead is very finely divided, and, like the first precipitate, liable to pass through the pores of the filter, as has been previously explained. This second series of experiments has been carried out, not from any expectation that the results would closely agree with those of the first series, but merely to control the latter to a certain extent, and to remove any objection which might be made to the indirect method by which they were obtained. Since the possible inaccuracies of the process tend to a loss of lead, we are confident that the amounts of lead we have obtained are in no instance greater than those really existing in the coin.

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* See Fresenius, Anleitung zur Quantitativen Analyse, (Braunschweig, 4te Aufl. 1858,) p. 286, § 132, II. b. β.

The precipitates of pure sulphate of lead (column (a) of the table) were, in every instance, reduced on charcoal with carbonate of soda, and the button of lead obtained carefully tested for silver, of which none could be detected in any case; nor did the metal exhibit any reactions, other than those of pure lead.

The residue of gold and filter paper left after dissolving the carbonate of lead in nitric acid for the final lead determination, was in each case incinerated, and then fused with carbonate of soda before the blowpipe. A distinct button of metallic gold was obtained in every instance. The amount of gold obtained varied, however, to a very considerable extent: it was abundant in the American and Spanish coin, less was observed in the English and Mexican, and but little in the French coin or the American fine silver.*

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* Compare Mulder, *op. cit.*, p. 217.

The silver of the French coin was undoubtedly prepared by the sulphuric-acid process,† in which the granulated alloy of silver, gold, copper, &c. is dissolved in hot concentrated sulphuric acid, and the silver subsequently precipitated, by means of metallic copper, from a somewhat diluted hot solution of the sulphate of silver thus obtained. Since ordinary commercial sulphuric acid* is used in this operation, it is not strange that a portion of the lead with which it is contaminated should be transferred to the silver. The lead salt is perhaps reduced by the metallic copper in the manner so well described by Odling, in his memoir "On the Reciprocal Precipitations of the Metals."† It is, moreover, not impossible that some sulphate of lead may fall when the acid liquor is diluted, and become mixed with the precipitated silver. It is not credible, however, that the lead in the coin can have been derived from the copper used to form the standard alloy, for this supposition would imply that copper of very inferior quality had been employed. According to Karsten,‡ copper which contains but one per cent of lead is utterly unfit for manufacturing purposes, since it cannot be worked at any temperature. Now the least amount of lead which we found in fifty cents' worth of American silver is 0.0253 gram. in 10 half-dimes of 1853. These 10 half-dimes contain 1.243 gram. of copper, and if this metal had been the source of the lead, it must have contained more than two per cent of that impurity.

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* Besides the quantitative analyses recorded above, which have been made by this method, it should be mentioned, that in several qualitative experiments upon American coins, by the method as described or slightly modified, indications of lead were obtained in every instance. The same remark is true of two qualitative analyses, — one of a dime and another of a quarter-dollar, — made as follows: the coin having been dissolved in nitric acid, and the insoluble black residue of sulphide of silver and a little gold separated by filtering, the solution was mixed with pure acetate of soda (see Fresenius, *op. cit.*, p. 428, § 163, 1. γ) to prevent precipitation of chloride of lead in subsequent operations, and the whole heated over the water-bath; the silver was then precipitated with dilute chlorhydric acid, and the chloride of silver collected upon a filter and washed. Through the filtrate sulphuretted hydrogen was passed, the mixed sulphide of copper, lead, and gold collected upon a filter, treated with nitric acid, the acid solution evaporated to dryness, the residue taken up with water, and the solution filtered; in the filtrate lead was detected, while the residue contained gold.

With regard to this residue of gold, which has also been alluded to in the text, it should be remarked that it has been entirely neglected by many analysts who have published determinations of the amounts of gold in various silver coins. Indeed, it would appear as if the fact were not generally known to chemists, that nitric acid can dissolve a little gold (as it can platinum), when an alloy containing a small quantity of gold is treated with this acid (compare Mulder, *op. cit.*, p. 159). Another common error of analysts has been, to class as "gold" the dark-colored residue which is usually left when silver coin is dissolved in dilute nitric acid. This precipitate does, in fact, generally contain a little gold, though in our own experiments by far the larger portion of this metal passed into solution in the nitric acid, and was separated at a subsequent stage of the analysis, as has been described; Gay Lussac (Ann. Ch. et Phys., 1836, [2.] LXIII. 334) long ago showed that it is principally composed of sulphide of silver; to which fact attention has also been called by Mulder, in his excellent little treatise, just cited, p. 178.

† See D'Arcet in Dingler's Polyt. Journ., 1828, XXVIII. 3; from Annales Mensuelles, Mai, 1827, p. 131. Also, Ure's Dictionary of Arts, &c., 4th edit., (Boston, 1853,) II. 543. Dumas's Traité de Chimie Appliquée aux Arts, (Paris, 1833,) IV. 464.

We are ignorant of the process of preparing silver which was in use at the British Mint in 1816. Perhaps the silver in the coin of that date was obtained by cupellation, and it is well known that silver so obtained almost always contains lead. §

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* D'Arcet, Journ. für tech. u. œkon. Ch., 1829, IV. 420.

† Quar. Journ. Chem. Soc. of London, 1857, IX. 289.

‡ In his System der Metallurgie, (Berlin, 1832,) V. 245.

§ Authorities differ as to the amount of lead contained in crude cupelled silver ("lightened silver," *argent éclairé*, *Blicksilber*). According to Berthier (Essais par la Voie Seche, (Paris, 1848,) II. 724), it contains, on an average, only 1 per cent of lead. Kerl (Handbuch der metallurgischen Hüttenkunde, (Freiberg, 1855,) III. 152), on the other hand, says that it contains from 5 to 10 per cent of impurity; and according to Karsten (System der Metallurgie, V. pp. 200, 201) Blicksilber contains at least 12 per cent of lead, and often more, the proportion of lead to silver being entirely dependent upon the temperature of the cupelling furnace. Since such silver is unfit for use, it is refined by small portions, either by a second cupellation at a high heat, or by melting it in crucibles with saltpetre and borax or some other flux (Kerl, *op. cit.*, III. pp. 181 to 198); but it appears to be impracticable, or at least not advantageous in practice, to remove the last traces of lead from the silver by either of these processes. (See Kerl, *op. cit.*, I. 224; or Plattner, Probirkunst mit dem Löthrohre, (Leipzig, 1853,) p. 403).

The silver of the Spanish and Mexican coins was doubtless prepared by the American system of amalgamation.* In this process, speaking in general terms, it would appear that silver is reduced by means of metallic mercury from a solution of chloride of silver in chloride of sodium, the amalgam which is formed being exposed meanwhile to the action of chloride of copper and perchloride of iron.

It is to be inferred from the investigations which we have cited, that under these circumstances the amalgam should be almost entirely free from any contamination with the more strongly electropositive metals.† It would seem, indeed, that the American system of amalgamation furnishes purer silver than is obtained by any of the other processes which are employed upon the large scale.

So far as concerns the occurrence of lead in the silver coin of our own country, it could probably be mainly, if not altogether, avoided, by employing zinc free from lead, such as is manufactured in Pennsylvania, as we have already described in our Memoir.

It is interesting to observe, that the occurrence of lead in some of the silver coins of the ancients‡ has been thought to indicate "that the process of separating lead and silver was less perfectly executed in the ages of antiquity than is at present the case."§ Yet, in none of the recorded analyses of ancient silver coins to which we have had access have we been able to find that any one has detected so large an amount of lead in these coins, as we have shown to occur in American fine silver of the year 1860, if we except a single analysis by Professor Draper, who found nearly 3 per cent of lead in a silver coin of Hadrian. The greatest percentage of lead observed by Brüel (the author of the remark just quoted) was only 0.12. It is probable, however, that the methods of analysis — none of which are recorded — employed for separating lead from silver by the chemists to whose labors we have referred, were less delicate than the process which we have ourselves made use of.

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* Described by Humboldt in his Essai Politique sur le Royaume de la Nouvelle Espagne, (Paris, 1811,) II. 558. See also Karsten, Abhandlungen der phys. Klasse der Akad. der Wissenschaften zu Berlin, 1828, p. 1; and Karsten u. Dechen's Archiv für Mineralogie, etc., 1829, I. 161; and again, *ibid.* XXV. 178, and in Dingler's Polyt. Journ., 1852, CXXVI. 357. Compare the subsequent statements of Boussingault, Ann. Ch. et Phys., 1832, [2.] LI. 350.

† In the European system of amalgamation, as practised at Freiberg in Saxony, where the silver is reduced from its chloride by metallic iron instead of quicksilver, a similar degree of purity in the silver is not to be expected. (For analyses of such silver, "Tellersilber," see Kerl, *op. cit.*, I. 234.)

‡ Walchner, Schweigger's Journal für Ch. u. Phys., 1827, LI. pp. 204, 205. J. W. Draper, Silliman's Am. J. Sci., 1836, [1.] XXIX. 160. Sarzeau, Journal de Pharmacie, 1839, XXV. 503. Brüel and Hausmann, Karsten u. Dechen's Archiv für Mineralogie, etc., 1844, XVIII. 505; also in J. pr. Chem., XXX. 334. J. W. Mallet, Trans. Royal Irish Acad., 1853, XXII. 319. Brüel and Hausmann refer also to earlier determinations of lead in antique coins by Klaproth (probably in his Beiträge zur chemischen Kenntniss der Mineralkörper, 1795 – 1780, B. VI.), and by Goebel (doubtless in his brochure, Ueber den Einfluss der Chemie auf die Ermittelung der Völker der Vorzeit, etc., Erlangen, 1842); but they do not indicate precisely where these analyses are to be found, nor have we any means of ascertaining this point.

§ Brüel and Hausmann, *loc. cit.*, Archiv. p 509; J. pr. Chem., p. 338.

It is interesting also in this connection to observe, that the American system of amalgamation, which at one time — before its peculiar fitness for the circumstances of the case in which it is employed had been recognized — was so frequently criticised by European metallurgists, affords silver which is less strongly contaminated with lead, and is probably purer in other respects, than is produced by any other process of manufacture.

II. *On the extreme Difficulty of Removing the last Traces of Carbonic Acid from large Quantities of Air.*

In the course of our research upon the impurities of zinc, we instituted a series of experiments, in order to ascertain whether the disagreeable odor of hydrogen gas, as generated from common zinc by means of sulphuric acid, could be attributed to the presence of any gaseous compound of carbon, — an apocryphal doctrine which seems to be quite generally credited.

The results of these experiments were entirely negative, in so far as they related to the point in question, and we should not have thought of publishing them, had it not been proved to us, by a memoir recently printed in Poggendorff's Annalen, that one of the phenomena which we then observed had not been sufficiently dwelt upon by chemists.

In our experiments above referred to, a jet of hydrogen was burned in a glass globe thirty centimetres in diameter, through which was drawn, by means of an aspirator, a steady current of air. Before entering the globe, this air had passed through an apparatus, described in full below, which was intended to deprive it of all its carbonic acid, and on leaving the globe it was drawn through a bottle containing lime-water, carrying with it, of course, the products of the combustion of the hydrogen. We first used, in order to absorb the carbonic acid completely from the air in which the hydrogen burned, two cylinders twenty-seven centimetres high and five centimetres in diameter, filled with fragments of pumice-stone moistened with caustic potash; not satisfied with this large absorption surface, we next added to the cylinders two Wolfe bottles containing a concentrated solution of caustic potash, and finally substituted for the Wolfe bottles three five-bulb potash-tubes. We repeatedly maintained a burning jet of hydrogen in the globe for periods varying from four to six hours, with air purified by passing through the three potash-tubes and two cylinders described, and always obtained the same result; viz. there was never any perceptible cloud of carbonate of lime in the bottle containing lime-water during the progress of the experiment, but after standing twelve hours, an unmistakable deposit of crystalline carbonate of lime was invariably found at the bottom of the lime-water. We might have regarded this as sufficient evidence of the presence of an infinitesimal amount of carbon in the hydrogen, had we not found by repeated trials, that the burning of the hydrogen had no influence whatever on the formation of this crystalline deposit. 156,000 c. c. of air (the contents of our aspirator), passed through the purifiers we have described, still retained sufficient carbonic acid to produce a deposit of crystalline carbonate of lime, when allowed time to separate from the lime-water by crystallization.* In order to render the experiment irreproachable, with reference to the determination of carbon in the hydrogen, we should have been obliged to extend indefinitely our absorbing apparatus, and to force the air through the whole apparatus, instead of sucking it through, as in the experiments above described. The object in view was not worth such trouble and expense, and we moreover had not the necessary appliances, so that we were reluctantly forced to give up the inquiry.

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* The fact that carbonate of lime may at first be dissolved by lime-water, has been clearly shown by Vogel. (Schweigger's Journ. f. Ch. u. Phys., 1821, XXXIII. 207.) It is moreover very distinctly affirmed in the following passage from an article, which has recently fallen under our notice, by Berthollet (Annales de Chimie, 1789, III. 68): — "I am indebted to M. Welter for an observation upon the use of lime-water, which may be useful in cases where one wishes to detect small quantities of carbonic acid. Lime-water has the property of dissolving a little carbonate of lime, of which one can assure himself by blowing into it with a tube; the air expired produces a cloud which redissolves entirely, until the lime-water is saturated with the carbonate of lime which has been formed. If, therefore, it is desired to detect small quantities of carbonic acid by means of lime-water, it is necessary to agitate some carbonate of lime with the latter, in order that it may be saturated, before filtering it." That the carbonate of lime separates after a time from the lime-water which had previously held it in solution, has also been shown by one of us (Am. J. Sci., 1858, [2.] XXV. 42), — at that time entirely ignorant of the experiments of Vogel and Welter.

Our interest in the subject has been awakened anew by some experiments recently published by H. Karsten,* upon the oxidation of dry non-nitrogenous organic substances by the action of atmospheric air at ordinary temperatures. The method upon which Karsten chiefly relied in these experiments was, in its essential features, identical with the one employed by ourselves, but the difficulty, to which we have referred, of removing carbonic acid from the air employed by any common absorption apparatus, is altogether ignored by him; † as will appear from the following description of his apparatus, quoted from page 349 of his article: "In order to purify from carbonic acid and water the air which I allowed to flow in a slow, continuous stream over the organic substances, I placed before the vessel which contained them chloride of calcium tubes several feet in length, and in front of these a tube containing dry caustic potash, preceded by a bulb-tube filled with concentrated solution of caustic potash; by this solution the air was first washed and freed from carbonic acid; it was then led slowly over the dry caustic potash and through the long chloride of calcium tubes, before it came in contact with the organic substances, which had been dried in the water-bath." It is evident, at all events, that this apparatus was far less adequate than our own for the difficult operation of removing carbonic acid from the air.

We do not in the least seek to deny the truth of Karsten's assertion, that carbonic acid is really formed by the action of air at ordinary temperatures upon the substances in question. The fact is not only probable *a priori*, but would seem to be proved by his incidental statement (p. 348), that carbonic acid was formed when these compounds (sugar, cork, &c.) were exposed during some months to the action of air or oxygen in tubes sealed with mercury in the pneumatic trough. In so far as charcoal is concerned, De Saussure* has long ago shown the extreme probability that it is oxidized by the air, even when dry, as it is when wet. Neither do we wish to assert that it is impossible to deprive air of every atom of its carbonic acid. We insist only upon the facts, that it is a matter of no inconsiderable difficulty to do this, that Karsten's apparatus was entirely inadequate, and that nothing in his paper would indicate that he has allowed for this source of error.

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* Poggendorff's Ann. der Phys. u. Ch., 1860, CIX. 346.

† The reader of Karsten's memoir will observe that, like ourselves, he obtained for the most part only crystalline carbonate of lime, — no immediate cloudiness.

It should be distinctly borne in mind, that in the experiments of Karsten, as well as in our own, the question raised is not at all whether the amount of carbonic acid which escapes absorption can be estimated with the balance; for so long as the experiments are qualitative only, and conclusions are based upon the precipitate which is formed in lime-water, it is clearly necessary to remove every trace of carbonic acid from the air employed, no matter how "imponderable" this trace may be. We do not believe that the carbonic acid which escapes absorption in ordinary experiments can be of sufficient amount to be mentioned as a source of inaccuracy in the determination of the carbonic acid of the air, by the method which has been used by so many eminent chemists; for the extent of the error thus introduced must be far less than that of several others to which the absorption process, as commonly employed, is exposed, and which have been pointed out by Hlaziwetz,† and in part also by the brothers Rogers.‡

So far as we know, those observers who have previously touched upon this subject have been occupied with quantitative considerations only. They have, therefore, very properly rested content, when by experiment they have satisfied themselves that the last potash-tube of their series no longer increased in weight during the space of time occupied by a single experiment.§ It must, however, be evident to any one who will perform the experiment, that the presence of an amount of carbonic acid which could not be detected by any weighing of potash-tubes may readily be made manifest by precipitating it as *crystallized* carbonate of lime. In this connection it should be mentioned that Brunner* has distinctly called attention to the extreme difficulty of completely absorbing carbonic acid from the air. Brunner could accomplish this neither by means of a solution of baryta, nor by a mixed solution of chloride of barium and caustic ammonia,† by bits of sponge moistened with baryta or lime-water, nor even by fragments of caustic potash, or asbestos moistened with a solution of potash; he finally chose slightly moistened hydrate of lime, as the best absorbent, and maintains that his method of determining carbonic acid in the air, by this means, is sufficiently accurate for all ordinary cases. ‡

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* Gilbert's Ann. der Phys., 1814, XLVII. 119, note.

† Wiener Akad. Bericht, 1856, XX. 189.

‡ Am. J. Sci., 1848, [2.] V. 115; Edin. New Phil. Journ., XLIV. 150.

§ Compare, for example, Dumas and Stass, *Sur la véritable Poids atomique du Carbone*, Ann. Ch. et Phys., [3.] I. 18.

Professor G. P. Bond presented a memoir on the Light of the Moon and of the Planet Jupiter, containing the results of photographic and optical experiments upon the light of these two bodies.

The rays from Jupiter have been found to possess a remarkable degree of chemical energy compared with those reflected from ordinary opaque substances on the earth, and from the Moon; a similar excess exists in the optical brightness of this planet. The chemical *albedo* of Jupiter, supposing the planet to reflect light after the usual manner of opaque substances, exceeds that of the Moon in the proportion of fourteen to one, the optical, in the proportion of eleven or twelve to one.

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* Poggendorff's Ann. der Phys. u. Ch., 1832, XXIV. 571.

† Having had repeated opportunities of observing the great difficulty — not to say impossibility — of absorbing carbonic acid from mixed gases, especially if these contain so much as one or two per cent of it, by means of these and similar liquids, I am glad to bear witness to the entire accuracy of this much-neglected statement. — F. H. S.

‡ It is a curious fact, which not only corroborates Brunner's observation, but also suggests a more extended use in the laboratory of his favorite absorbent, that manufacturers of coal-gas find in practice, that carbonic acid, when not present in very abnormal quantity, may be readily removed from the impure gas by passing the latter through several layers of dry hydrate of lime, spread in fine powder upon perforated iron grates or upon shelves of basket-work ("dry-lime purification"); while it is practically *impossible* to absorb all the carbonic acid from similar gas by the wet system, in which the impure gas is forced through milk of lime contained and agitated in several successive purifiers. Yet with the other chief impurity of coal-gas, sulphuretted hydrogen, the reverse of this is the case, for by means of the wet-lime purification, this substance can, in ordinary cases, be very readily and completely removed with an expenditure of but little lime, while with the dry purification this result is far less easily attained. Moreover, this non-absorption of carbonic acid in the wet-lime purifiers cannot be due to any interference caused by the sulphuretted hydrogen, for it is just as difficult to absorb all the carbonic acid from rosin-gas, which contains no sulphuretted hydrogen, as it is to absorb that in the gas prepared from coal.

The experiments are open to the large uncertainties to which photometric comparisons are ordinarily liable; but, assuming their correctness, and that, as there is good reason to suppose, the proportion of sunlight incident on the Moon which is absorbed at its surface, compared with the amount reflected, is less than the smallest of the abovementioned ratios, it would follow that the planet shines in part by native light, agreeably to the old notion of its phosphorescence. It is difficult to put any other construction upon the experiments, provided that Lambert's theory of the quantity of sunlight reflected to the Earth from a planet is applicable in the case of Jupiter. Perhaps a more acceptable explanation is, to suppose that its surface has the property of returning towards the Sun a disproportionate amount of the whole quantity reflected, taking ordinary opaque substances as a standard.

That this condition obtains with the Moon may be inferred from the fact, that at the full, the margin of its disk is brighter than the central regions, indicating a peculiarity in the constitution of its surface which would be likely to produce an excess of brightness at full moon. It is, moreover, placed beyond question from a consideration of the observed variations of the illuminating power of the different phases of the Moon, of which a detailed account is given in the memoir,— showing that the theoretical representations of the intensity of moonlight, in its changes from new to full and *vice versa*, as investigated by Euler and Lambert, bear no resemblance to the actual variations in the amounts transmitted to us. As Jupiter always presents a nearly full phase to the Earth, a similar property of reflection in its surface would tend to explain the anomaly. There is, however, this objection to that hypothesis: while the superior marginal brightness of the full Moon, whatever may be its cause, would naturally lead us to anticipate just that deviation from Lambert's theory of the amount of illumination derived from it which is actually observed to occur, the reverse order in the distribution of light over the disk of Jupiter, namely, its regular increase from the margin to the centre, in very good accordance with the same theory, is a strong argument for adopt-ing the latter as properly applicable to the planet; in which case the explanation suggested would no longer be admissible.

According to the observations communicated, the light of Jupiter, seen from the Earth at its mean opposition, is to the light of the mean full moon as 1 : 6430. Compared with the light of Venus at its greatest brightness, it is as 1 : 4.864.

Professor Bond also read a memoir on the relative brightness of sunlight and moonlight.

Of the results given by Bouguer and Wollaston, for the proportion between sunlight and the light of the full Moon, viz.:

Bouguer . . . . $s = 300{,}000$
Wollaston . . . . $s = 801{,}072$

the preference has been generally given to the latter. Reasons are adduced in the present communication for considering Bouguer's method of observation to be the best of the two, and his results deserving of most confidence. Comparisons, by means of Bengola lights, of the images of the Sun and Moon reflected from a silvered globe, give the value,

$$s = 471{,}000.$$

Other methods, less reliable, also tend to confirm Bouguer's determination.

Professor Bond also communicated a Catalogue of Stars near the Zenith of the Observatory of Harvard College, collected from the best existing authorities, having for its object to furnish to astronomical surveyors in the region of the Great Lakes and elsewhere, nearly in the same parallel, accurate star-positions for the determination of latitude by the zenith telescope.

Professor Agassiz discoursed upon the application of his principles of classification to the systematic arrangement of Polyps.

Professor Cooke, announcing the favorable result of his recent personal application, in behalf of the Academy, to the Royal Astronomical Society, the Geological Society, and the Museum of Practical Geology, London, to supply deficiencies in the Academy's set of their publications, moved, and it was voted, —

"That the special thanks of the Academy be presented to these institutions for their marked interest and courtesy in this behalf, and for their very valuable gifts."

Mr. Thurber of New York, by permission of the Academy, exhibited an ingenious adaptation of the pantograph, by which partially paralytic persons, unable to write in the ordinary way, may write with great facility.

Four hundred and eighty-seventh meeting.

October 9, 1860. — MONTHLY MEETING.

The PRESIDENT in the chair.

Dr. Hayes, in presenting a "Report on supplying the City of Charlestown with pure Water, made by Order of Hon. James Dana, Mayor, by Messrs. George R. Baldwin and Charles L. Stevenson, Civil Engineers," remarked, that

Chemical analysis presents points of interest relating to the composition of the water of Mystic Pond. The results obtained on carefully selected samples of this water, recorded in the Report, show a great variation existing at different parts of the mass of water. The weights of solid matter found in a standard gallon, are 4.08 gr., 4.64 gr., 15.52 gr., 16.88 gr., and 58.64 gr. Below a certain depth, the nearly pure water of this pond reposes on a heavier saline water. Further observations have shown that this saline water, closely resembling sea-water, maintains a nearly constant level in relation to the purer water reposing on it, and that the saline diffusion is apparently very slight in amount, or very slow in point of time. Change of temperature does not cause an intermixture of the two kinds of water; as the lower stratum has a density superior to that of the pond-water at its greatest density, and, physically, the conditions of repose are nearly the same, so far as penetration is concerned, as if a saline sand-bottom held the place occupied by the heavier water.

This pond, containing two kinds of water, can support the plants and animal organisms of fresh water and of ocean water at the same time.

Its sedimentary deposits may contain the remains of both fresh and saline water forms of life within the same area, thus offering an interesting subject to the observation of the naturalist.

Chemically considered, these two differing masses of water in contact exert powerful action. The organic matter suspended and dissolved in the fresh water, brought into contact with the saline water, leads to a number of decompositions of compound bodies. All the phenomena exhibited by ocean water in contact with water passing through the earth and entering the sea below its surface, are seen in this pond most distinctly. Thus, the sulphate of lime becomes decomposed into a salt composed of hydrosulphuric acid and lime, this new salt reacts on oxides of the common metals to produce sulphides and carbonate of lime, or upon sulphates of alkalis, so as, in presence of an excess of carbonic acid, to produce carbonate and bi-carbonate of soda, which may enter into new forms of matter. A bright metal plate immersed in this water at a certain depth may be exposed for hours to the action of the water without change. But if the slip be allowed to pass deeper, so as to reach the saline water, in the lapse of a few minutes it becomes coated with sulphide of the metal. The engineers engaged in the observations on the pond lowered a long silvered slip of copper vertically, so it should pass through the mass of fresh and saline water. On withdrawing the slip, after some hours had elapsed, the line of contact of the masses of waters was permanently marked on the slip, — all above it was unaltered, all below was blackened on the copper side by the formation of sulphide of copper. It was extremely interesting to note that the band presented no gradation of chemical action. Within the distance of *one fourth of an inch*, action and no action were marked, and it was in this way, as well as by chemical analysis, that the fact of the masses preserving their places was learned. Down into the fresh water, to within twelve inches of the saline water, the taste does not indicate the slightest saline taint, and even nearer the mass which produces so powerful chemical changes, the water is nearly pure. There is manifested in this juxtaposition of two waters of unlike composition some of the minor effects of electrical action, and in considering the chemical changes which may be and are exhibited in consequence, it appears that such a condition would be sufficient to account for the production of many bodies, which have been supposed to result from more active agencies only.

Mystic Pond, as at present constituted, consists of a thick stratum of nearly pure water, resting on an undisturbed mass of saline water, closely resembling that of the ocean.

Professor Cooke exhibited some octohedral crystals deposited on a furnace product, which he had obtained accidentally while experimenting on the compound of zinc and arsenic. The crystals were so brilliant that their angles could be measured with great precision, and they gave the exact angle of a regular octohedron. The composition of the crystals as shown by analysis was, zinc 81.18, arsenic 18.82. Professor Cooke argued that the arsenic in the crystals was present mainly in the condition of impurity, and stated his reason for this opinion. He considered therefore the crystals as showing that zinc might crystallize in forms of the monometric system.

He also exhibited a counterfeit American gold coin, of a specious character, the gold abstracted from the interior being ingeniously replaced by platinum.

Professor Horsford gave additional details upon spontaneous combustion, and mentioned a case in which iron-turnings saturated with oil had been known to ignite.

Dr. Beck, calling attention to the fragment of Petronius discovered by him, and communicated by him to the Academy about a year ago (now published in the eighth volume of the Memoirs), read the following extract from a letter received from Prof. Hertz of Greifswalde.

"The ineditum which you have sent me has been these fourteen years lying in my portfolio. I found it in a codex of the Marciana, and copied it, but delayed publication. I am glad that you have, in part, given it more complete than my codex presents it. It is mentioned, however, earlier than the edition of Anthon, for which you may find the proofs, which I have not at hand in this little watering-place in the Baltic, in Goldast's Sylloge Adnotationum in Petronium. In many things, this Petronius agrees with Isidorus in his Origines, which, in my opinion, he has used; its importance for Gellius is, as I think, subordinate. It was my original intention to publish the piece with the readings of the Venetian MS. in the Rhein

Museum, and to accompany it with my remarks; and I delayed my answer to you until I might, with my thanks, send you a copy of my article. But when I commenced the work, I saw that the so-called Petronius had besides profane authors used patristic sources, of which, under the article *Choirogryllus*, you have yourself given an example. But to trace and investigate the single articles, time was wanting, and I wrote, therefore, to Professor Ritschl, to whom I had already offered my article, of my change of intention, and offered to communicate my copy, in case some one of his pupils should wish to render the fragment accessible to German philologists. An able young philologist in Bonn, Dr. Reifersheid, has undertaken this task, as Professor Ritschl has lately informed me, and in a week, when I shall be again in Greifswalde, I shall send my copy of the Venetian MS. to Bonn, and take care that you receive a copy of Dr. Reifersheid's article.

Professor Agassiz reiterated his opinion that what are called varieties by naturalists do not in reality exist as such. His recent study of the Echinoderms in the collection of the Museum of Comparative Zoölogy at Cambridge, had confirmed this opinion. He found a great abundance of divergent forms, which without an acquaintance with the connecting ones, and large opportunities of comparison, might be taken for distinct species, but he found that they all passed insensibly into each other. In reply to a question, he stated that he discarded the sterility or fertility of crosses from the tests of the validity of species.

Professor Parsons suggested that more extended observation might connect the received species by intermediate forms, no less than the so-called varieties.

And Professor Gray remarked that the intermediate forms connecting, by whatsoever numerous gradations, the strongly divergent forms with that assumed as the type of the species, so far from disproving the existence of varieties, would seem to furnish the best possible proof that these were varieties. Without the intermediate forms they would, it was said, be taken for species; their discovery reduced them to varieties, — between which, but not between species (according to the ordinary view), intermediate states were to be expected.

Four hundred and eighty-eighth meeting.

November 14, 1860. — STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters received since the preceding meeting.

Mr. E. B. Elliott read a paper "On the Calculus of Affected Quantities," in which was proposed a general unit-symbol of mononomial form, intended to embrace as particular cases, and to define the several affective symbols of, single, double, and quadruple algebra.

Professor J. Wyman presented and gave an analysis of a paper by Dr. John Dean, on the minute structure of the spinal cord.

Professor William B. Rogers described a simple application of the camera lucida for obtaining twin drawings, suitable for combination in the stereoscope.

For this purpose the reflecting prism, movable along a horizontal rod, must be adjusted successively in the positions proper to the right and left eyes respectively, when these are directed upon the object. The two pictures projected on the horizontal paper below, and traced out in the usual way, will represent the two aspects of the object as seen by the right and by the left eye severally, and, when united by means of binocular combination, they will reproduce the object visually in all its original relief.

As connected with the same subject, Professor Rogers referred to an arrangement for the binocular analysis of a perspective physical line described by him some years ago in the American Journal of Science.

In this the line was placed directly behind a vertical plate of clear glass, while the observer, keeping his head in a fixed position, viewed the line with one eye at a time, tracing on the glass the projections corresponding to its appearance, as seen by the right and left eyes respectively. The projections thus drawn will, of course, when binocularly combined, reproduce the original perspective line. In the same manner, a more complex object placed behind the glass plate may be represented in its two projections by pictures capable of a perfect binocular combination.

The following gentlemen were elected Fellows of the Academy: —

Charles Eliot Norton of Cambridge, in Class III., Section 4.

Ephraim W. Gurney, of Cambridge, and Rev. Horatio B. Hackett, of Newton, in Class III., Section 2.

The following were chosen Associate Fellows: —

Dr. F. A. P. Barnard, President of the University of Mississippi, in Class I., Section 3.

Professor John Le Conte, of Columbia, South Carolina, in Class I., Section 3.

Dr. J. W. Dawson, Principal of McGill College, Montreal, in Class II., Section 1.

Professor W. D. Whitney of Yale College, in Class III., Section 2.

The following were elected Foreign Honorary Members: —

Professor Dové, of Berlin, in Class II., Section 1.

Professor Albrecht Kölliker, of Würtzburg, in Class II., Section 3.

Von Rauch, of Berlin, in Class III., Section 4.

Four hundred and eighty-ninth meeting.

December 11, 1860. — MONTHLY MEETING.

The PRESIDENT in the chair.

Letters of acceptance were read by the Corresponding Secretary from Charles E. Norton, Ephraim W. Gurney, Professor John Le Conte, and Principal J. W. Dawson, elected into the Academy at the preceding meeting.

Professor Sophocles read the following communication: —

On some Magnesian and Pagasetic Inscriptions.

Last June, while at Tsangarádha (ἡ Τσαγγαράδα), a village situated on the eastern slopes of Mount Pelion, and belonging to the district of Volo, I received from Mr. Arghíris Philipídhis (Ἀργύρης Φιλιππίδης) copies of two ancient Greek inscriptions, found, as he informed me in a letter, at Miliés (ἡ Μηλιές), another village of the same district. This gentleman is very familiar with the topography of the south-western slopes of Pelion.

One of these inscriptions was discovered, according to him, forty years ago, at Búpha (ἡ Μπούφα), a place in the immediate vicinity of Good Waters (τὰ Καλὰ Νερά), on the shores of Miliés. It formed part of the holy table (ἡ ἁγία τράπεζα) of a dilapitated church at that place.

*Inscription of Búpha.**

. . . .

ἀνιεὶς ἱερεῖα τέλεια λευκὰ ὁλόκληρα
θύ]εσθαι τῷ θεῷ καὶ τὰ ἄλλα τὰ ἐθιζόμενα καθὼς . . . .
ἐ]γίνετο· τὰς δὲ τούτων δορὰς πωλεῖσθαι ἀπὸ τοῦ . . .
κα]τ' ἐνιαυτὸν ὑπὸ κήρυκα τῇ ἕκτῃ ἐπὶ δέκα τοῦ ἀρτεμί-
ου μη]νὸς πρὸ τῆς ἐκκλησίας τῆς γενομένης ἐννόμου ἀπὸ τοῦ
. . . μου ὑπὸ τῶν προγεγραμμένων ἀρχόντων, συμπαρόντων καὶ τ[οῦ
ἱερέ]ως τοῦ Διὸς τοῦ ἀκραίου καὶ τῶν ἐξεταστῶν καὶ τὸ ἐκ τούτων
συν]αγόμενον διάφ[ορον . . .] παρὰ τῷ ἱερεῖ τοῦ Διὸς τοῦ ἀκραίου.

. . . .

From the expression τοῦ ἀρτεμισίου μηνός one might be tempted to refer the inscription to the Alexandrian period. But it may with equal confidence be referred to the Roman period. For although the Roman calendar began to be adopted by the Greeks as early as the first century,† the Macedonian mode of dating had not become obsolete even as late as the second century of the Christian era. Thus, the names of some of the Macedonian months occur in the Apostolical Canons and Constitutions.‡

As to the expression τοῦ Διὸς τοῦ ἀκραίου, it is to be recollected that by θεοὶ ἀκραῖοι, *the gods of the citadel*, the Greeks meant the gods whose temples were in the citadel.§ And as every important city had its citadel, it is natural to suppose that it had also its θεοὶ ἀκραῖοι.

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* Αὕτη ἡ ἐπιγραφὴ ἀνεκαλύφθη ἐν τῇ κατὰ τὴν Βοὔφαν παλαιοεκκλησίᾳ. ARGHÍRIS PHILIPÍDHIS.

† See GLOSSARY of Later and Byzantine Greek, v. πρό 2.

‡ CAN. APOST. 37. CONST. APOST. 5, 14, 1. 5, 17, 2.

§ POLLUX, 9, 40 Ἀκρόπολις, ἣν καὶ ἄκραν ἂν εἴποις καὶ πόλιν, καὶ τοὺς ἐν αὐτῇ θεοὺς ἀκραίους καὶ πολιεῖς. ECKHEL, 2, p. 504 Θεοὶ ἀκραῖοι, on Mytilenian coins.

Ζεὺς ἀκραῖος is found on Smyrnæan coins[*] and in a Smyrnæan inscription.[†] And according to Dicæarchus there was a temple of Ζεὺς ἀκραῖος on the highest peak of Mount Pelion,[‡] that is, on what is now called Pliasídhi[§] (τὸ Πλιασίδι), or *the mountain of Portariá* (τὸ βουνὸ τῆς Πορταριᾶς). Now, as this inscription was found in the vicinity of this peak, it is natural to suppose that its Ζεὺς ἀκραῖος is identical with the Ζεὺς ἀκραῖος of Dicæarchus.

The other inscription, according to the same gentleman, was discovered last spring at Zerbhókhia (ἡ Ζερβόχια), in the township of Nekhóri (τὸ Νεχώρι). It was dug up by an ignorant person who was losing his time in searching for ancient hidden treasures. Near the spot where it was found there was a tomb containing human bones. The marble is now to be seen at Bizítsa (Βιζίτζα), a small village not far from Miliés.

Inscription of Zerbhókhia.[‖]

Ἐν ταύτῃ τῇ θήκῃ οὐκ ἔξεστιν οὐδέ[ν' ἄλ-
λον, οὔτε ἄνδ[illegible] οὔτε γυνέκα (sic) ταφῆ[ναι.
Ἐὰν δέ τις ἀπονοηθεὶς τολμήσει [ἀνοῖ-
ξε (sic), ἔξι (sic) κεχολωμένον βασιλέα [θεὸν
μέγιστον παντοκράτορα κτίστ[ην
ὅλων καὶ θεοὺς πάντας καὶ θε[ὰς καὶ
ἥρωας καὶ αὐτὴν τὴν δέσποιν[αν
βασιλίδα, διὰ τὸ ἅπαξ ἀπηγορε[ῦσθαι
ἕτε]ρον σῶμα μετὰ τούτων τεθῆ[ναι.

Translation.

No other corpse, whether of a man or of a woman, is permitted to be deposited in this vault. And if any one shall recklessly dare to open it, he will anger the most great [god] the king, the almighty maker of

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[*] Eckhel, 2, p. 508.

[†] Inscr. 3146.

[‡] Dicæarch. Descript. Græc. 2, 8 Ἐπ' ἄκρας δὲ τοῦ ὄρους κορυφῆς σπήλαιόν ἐστι τὸ καλούμενον Χειρώνιον, καὶ Διὸς ἀκραίου ἱερόν.

[§] Πλιασίδι, ιοῦ, τὸ, is the modern double diminutive of Πήλιον, but without its diminutive sense. It is formed as follows: Πήλιον, Πηλιάσιον (analogous to κοράσιον), Πηλιασίδιον, (analogous to κορασίδιον), Πλιασίδιον, and by omitting the ending -ον, Πλιασίδι, pronounced in three syllables; thus, Πλια-σί-δι.

[‖] Ἡ ἐπιγραφὴ αὕτη εὑρέθη κατὰ τὴν Ζερβόχιαν. Arghiris Philipidhis.

all things; and [he will anger] *all the gods and goddesses and demigods, and the lady queen herself. For the depositing of any other corpse* [together] *with these is forbidden once for all.*

Here it is impossible not to see that the maker of all things is the Hebrew god, and that he is classed with the gods of the heathens. Now in order to understand this apparently incongruous medley of Judaism and Heathenism, it is to be borne in mind that even before the commencement of the Christian era many of the Gentiles of Western Asia, especially the women, adopted the religion of Moses.[*] Sober-minded and austere people, it would seem, preferred Jewish morality to heathen licentiousness. Circumcision was not required of the converts at first. The stricter of the Jews, however, regarded it as one of the essentials of religion.[†] Proselytes to Judaism were called by the Greek Jews *οἱ Ἰουδαΐζοντες*, *Judaïzers*, *οἱ σεβόμενοι τὸν θεόν*, or simply *οἱ σεβόμενοι*, *the worshippers of god*, that is, of the god of the Jews.[‡] Among these converts, it is natural to suppose, there were some who, although willing to venerate and even to give the precedence to the god of the hated and despised nation, were by no means ready to admit that he was the only god in existence. They could not see why the addition of a barbarian god to the received list rendered it necessary for them to discard the gods of their forefathers. And such seems to have been the author of the Magnesian inscription before us. People of this liberal tendency are not wholly unknown in the East even now. Thirty years ago there was a Mussulman in Cairo who believed that Christ was as good as Mohammed. His Greek friends, who could not conceive of religious sincerity unaccompanied by intolerance, applied to him the epithet *θεομπαίχτης* (from *θεός*, *ἐμπαίζω*), *the mocker of God.* It is hardly necessary to mention here the case of the Emperor Alexander Severus, who seriously thought of erecting a temple to the new god Christus.*

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[*] Joseph. Ant. 20, 2, 1 *Τῶν Ἀδιαβηνῶν βασιλὶς Ἑλένη καὶ ὁ παῖς αὐτῆς Ἰζάτης εἰς τὰ Ἰουδαίων ἔθη τὸν βίον μετέβαλλον.* Ibid. 20, 2, 3 et seq. Bell. Jud. 2, 20, 2 *Ἐδεδοίκεσαν δὲ* [*οἱ Δαμασκηνοὶ*] *τὰς ἑαυτῶν γυναῖκας ἁπάσας πλὴν ὀλίγων ὑπηγμένας τῇ Ἰουδαϊκῇ θρησκείᾳ.* 7, 3, 3 *Ἀεί τε προσαγόμενοι ταῖς θρησκείαις πολὺ πλῆθος Ἑλλήνων, καὶ ἐκείνους τρόπῳ τινὶ μοῖραν αὐτῶν πεποίηντο.*

[†] N T. Act. 15, 1. 16, 1 seq. Joseph. Ant. 20, 2, 4, Izates is circumcised. Tacit. Histor. 5, 5.

[‡] N T. Act. 13, 43. 50. 17, 4. 17. 18, 7. Joseph. Ant. 14, 7, 2 *Πάντων τῶν κατὰ τὴν οἰκουμένην Ἰουδαίων καὶ σεβομένων τὸν θεόν.* Bell. Jud. 2, 18, 2 *Τοὺς Ἰουδαΐζοντας εἶχον ἐν ὑποψίᾳ.*

With respect to the god of the Jews, the Greeks called him *Iao* ('Ιαῶ, rarely 'Ιάω, a word representing approximately the pronunciation of יהוה in the first century before Christ), and regarded him as one of the many gods of the universe. There is no evidence that they identified him with any of their known gods. Thus, Diodorus of Sicily, in speaking of the Jews, says that Moses, their lawgiver, received his laws from the god *Iao*,† so called. It would seem further that heathen magicians made use of 'Ιαῶ in their incantations, together with other appropriate divinities.‡ Strabo's knowledge on the subject of the Hebrew god was very imperfect. He asserts that Moses taught the Jews that *god* was identical with *nature;* that is, he makes the greatest of the Jewish prophets a teacher of pantheism.§

Josephus, however, in his fabulous account of the miraculous translation of the Hebrew books into Greek, represents a learned Alexandrian as saying to Ptolemy Philadelphus that the god of the Jews was identical with the Hellenic Zeus. And in an oracle forged by some Judaizing Greek, *Iao*, the most high god, appears as *Aïdes* or *Hades* in the winter, as *Zeus* in the spring, as *Helios* (*Sun*) in the summer, and as *Iacchus* in the autumn.‖ This is another species of pantheism.

But who is the *Lady Queen* of the inscription? Were we to adopt the practice of the most popular interpreters of the Bible, namely, to transfer the floating notions of the present day to the past, we should at once affirm that she can be no other than the Virgin Mary. This, however, would bring the date of the inscription down to the sixth century; for the epithet *δέσποινα* did not begin to be applied to the Deipara long before the Justinian age. And it may be said that, as Justinian was the professed exterminator of the ancient religion of Greece and Rome, it would not have been safe for any one of his subjects to profane the name of the god of the emperor, by putting it in juxtaposition with the gods of the heathens. It must be added here, that this epithet began to be given to the empress as a title about the same period. But it is not easy to believe that the *Lady Queen* of the inscription refers to the emperor's wife. She must have been a goddess.

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* LAMPRIDIUS, Alex. Sever. 29 In larario suo (in quo . . . Christum, Abraham, et Orpheum et hujusmodi deos habebat). Ibid. 43 Christo templum facere voluit eumque inter deos accipere.

† DIOD. 1, 94.

‡ INSCR. 5858, *b*, *Δαίμονες καὶ πνεύματα . . . . ἐξορκίζω ὑμᾶς τὸ ἅγιον ὄνομα . . .* 'Ιαῶ *. . . ὁ τῶν ὅλων βασιλεὺς ἐξεγέρθητι* [*καὶ*] *ὁ τῶν φθιμένων βασιλεὺς . . . μετὰ τῶν καταχθονίων θεῶν.* See also IREN. 1, 4, 1.

§ STRAB. 16, 2, 35 *Εἴη γὰρ ἂν τοῦτο μόνον θεὸς τὸ περιέχον ἡμᾶς κ.τ.λ.*

‖ MACROBIUS, 1, 18 *Φράζεο τῶν πάντων ὕπατον θεὸν ἔμμεν* 'Ιάω, *Χείματος μέν τ' 'Αΐδην, Δία δ' εἴαρος ἀρχομένοιο,* 'Ηέλιον *δὲ θέρευς, μετοπώρου δ' ἁβρὸν* 'Ιάω. The last word is obviously a mistake. The true reading seems to be *Ἴακχον*, the god of autumn when *wine* begins to be abundant. Lobeck's emendation *Ἄδωνιν* is not tenable.

It may be supposed also that she is the same as *Isis*, the great goddess of Egypt. Her worship indeed was quite fashionable in Greece during the Roman period, and her name appears in connection with Sarapis, Anubis, and Harpocrates, in several of the Delian inscriptions;* but I am not aware that the Greeks ever designated her by the appellation *the Lady Queen*.

Pausanias informs us that *the Lady* (ἡ Δέσποινα) was the daughter of Poseidon and Demeter. This distinctive epithet was analogous to *the Maid* (ἡ Κόρη), the popular name of *Persephone* or *Persephoneia*, the daughter of Zeus and Demeter. Pausanias is prevented by his religious scruples from disclosing her real name to the uninitiated. He only states that Δέσποινα bears the same relation to this mystical divinity, that Κόρη does to Περσεφόνη. This *Lady* was the favorite goddess of the Arcadians.† And if we assume that she is identical with the *Lady Queen* of the inscription, it is natural to infer that her worship was not confined to Arcadia.

On the walls of the church of Saint Nicholas (ὁ Ἅγιος Νικόλαος), near what is called, by courtesy, *the Fort of Volo* (τὸ Κάστρον τοῦ Βόλου), I found the following sepulchral inscriptions. The slabs had been brought from the ruins of Pagasæ, in the vicinity of said fort. With one exception they contain nothing but proper names and adjectives derived from proper names. I copied them in conformity with the philological canon that no ancient writing should be suffered to perish.

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* Inscr. 2293. 2295. 2302.

† Paus. 8, 37, 9 (6) Ταύτην δὲ *μάλιστα θεῶν σέβουσιν οἱ* Ἀρκάδες τὴν Δέσποιναν, *θυγατέρα δὲ αὐτὴν* Ποσειδῶνός *φασιν εἶναι καὶ* Δήμητρος. Ἐπίκλησις *εἰς τοὺς πολλούς ἐστιν αὐτῇ* Δέσποινα, *καθάπερ καὶ τὴν ἐκ* Διὸς Κόρην *ἐπονομάζουσιν, ἰδίᾳ δὲ ἐστιν ὄνομα* Περσεφόνῃ, *καθὰ* Ὅμηρος *καὶ ἔτι πρότερον* Πάμφως *ἐποίησαν.* Τῆς δὲ Δεσποίνης *τὸ ὄνομα ἔδεισα εἰς τοὺς ἀτελέστους γράφειν.* For this unwillingness to reveal the true name, compare Her. 2, 170 *Εἰσὶ δὲ καὶ αἱ ταφαὶ τοῦ οὐκ ὅσιον ποιεῦμαι ἐπὶ τοιούτῳ πρήγματι ἐξαγορεύειν τοὔνομα ἐν* Σάϊ.

Pagasetic Inscriptions.

ON THE NORTH WALL.

1.

Ἀπολλωνία
Ἀρχιμένους
γυνή.

2.

Σῶσος
Σώσιος
Νάξιος.

ON THE WEST WALL.

. . . . .
Ἀλεξάνδρου
Ἡρακλεῶτις.

ON THE SOUTH WALL.

1.

Διογένης
Ἡρακλείδου
Μακεδών.

Ἦ ῥα ποθεινὸς πᾶσιν ἔβης δόμον Ἄϊδος οὔπω
Εἴκοσ' ἐτῶν, μῆνας δ' ἐξ ἔτι λειπόμενος,
Διόγενες· γένος ΔΕ ΛΥΓΙ. ΝΣΤΥΓΙ. ΝΤΕΓ. ΝΕΥΣΙ
Κάλλιπες ἀΐδιον ΓΗΡΔΙΤ . . . MEN
Ἀλλ' [ο]ὐκ ἔστι τύχην προφυγεῖν καὶ δαίμονα ΝΗΤ
Οὐδὲ παρώσασθαι M.ΙΣΙΜ..N..I τὸ χρε[ών.

2.

Αἰσχίνου.

3.

Κλεοπάτρα
Στησιμένους
Πελλαία.

ON THE THRESHOLD OF THE SOUTH DOOR.

Μύλλις
Θεοκρίτου
γυνή.

Professor Jeffries Wyman, exhibiting a stereoscopic view of the skeleton of a double human fœtus, discussed the question of the mode of origin of such monstrosities, and insisted that they never arose from actual coalescence of two individuals, but from the more or less extensive longitudinal division, or rather bifurcation, of the primitive stripe of the ovum, with which the development of the embryo begins. He was thus led to consider the question of individuality, and to maintain the ground that, since the two bodies or parts of bodies were not formed by the coalescence of two originally distinct primitive stripes, therefore they were to be regarded as one individual, even in a case so extreme as that of the Siamese twins.

This view was criticised by Professors Parsons, Bowen, and Gray, the latter assenting to this view of the origination of such double individuals, as agreeing with the chorisis or similar doubling of organs in the vegetable kingdom; but insisting that to call the Siamese twins one individual was a practical *reductio ad absurdum* of that idea of individuality, and that individuality should be considered as of complete or incomplete realization; e. g. that a bicephalous monster was the result of an incomplete development, the Siamese twins, of an essentially effectual development of two individuals out of the foundation of one, or in the normal place of one.

Dr. C. Pickering submitted a statement relative to the geographical distribution of species, viz.: —

That his experience as a naturalist had led him to the conclusion, that the main limiting cause in the diffusion of species is to be found in the envelope of the ovum; in other words, the shell of the ovum governs the diffusion of species.

When the shell of the ovum breaks before exclusion, as in animals called viviparous, the species cannot be diffused by means of ova.

Other organic beings capable of locomotion are diffused both by ova and the wandering progeny; but plants are diffused exclusively by ova.

Change the order of Nature; let the ova of insects be all borne about by the winds and waves, and insects would disappear from the planet:

Or fasten the seeds of plants, hide them away in the select situations in which insects deposit their ova; and plants in their turn would in the end become extinct.

At some future day, when the envelope of ova shall have received more attention from naturalists, the ovum alone may probably be found to point out, with very considerable accuracy, the geographical distribution."

Professor Gray made some critical remarks, suggesting that

The problem of determining the geographical distribution of a species from the condition of its ovum or seed might be expected to transcend human powers in any supposable state of our knowledge of the latter, even if the principle announced were theoretically admissible to the full extent. Aptitude for dissemination was one element, but only one out of several. That it was by no means always the determining element, at least in the vegetable kingdom, might be inferred from the fact, that, while as a whole the seeds of the vast order Compositæ were endowed with unusual facilities for dispersion, the species on the whole were not at all remarkable for wideness of range, but rather the contrary; and, what seemed more paradoxical, Dr. Hooker had shown that (at least in some parts of the southern hemisphere) those Compositæ provided with a downy pappus, like that of *Senecio*, were in general more restricted in their actual geographical range than those destitute of a pappus. The vast genus *Senecio* has a downy pappus in all its species; but although the genus is cosmopolite, the species appear to be more than usually restricted, each to one district.

Professor Bowen made some observations upon *Instinct*. He remarked that there are three distinct questions concerning this faculty, which need to be carefully distinguished from each other.

1. What are the characteristics of Instinct?

2. What is the relation of Instinct to Intellect properly so called, — that is, to human Intellect, — and is the difference in kind or only in degree?

3. Whether Instinct and Intellect are ever conjoined, or found to exist together in the same being, either in the brute or in man.

The answer to these last two questions has been confused, or rendered difficult, chiefly because the answer to the first has been left vague and indeterminate. So long as the word Instinct is vaguely used to designate *all* the mental endowments of the brute, be they what they may, — and so long as the word Intellect is used with equal vagueness to designate all the mental endowments of man, be they what they may, — so long it will be impossible to draw a sharp line of distinction between the two, or to say that the two are never conjoined in the same being.

What, then, are the mental endowments which belong in common to man and the brute, but which are not entitled to be called either Instinct in the one case, or Intellect in the other? The following are at least some of them, perhaps all.

Appetites; propensities, including blind or involuntary imitation; affections; memory, and simple imagination, or the power of calling up mental pictures of individual material objects, both being manifested in the dreams of dogs; simple association, — as when a gesture or a rod suggests to an animal the pain of a previous whipping; and judgment in its simplest form or lowest function, resulting from the direct comparison of one material thing, observed at the moment, with another, — as when dogs and cats judge correctly the height or distance which they can safely leap, or the size of the orifice that will admit the passage of their bodies.

Neither Intellect nor Instinct is necessary for the *action* of the appetites, impulses, or affections; though one or the other is needed to obtain the means of gratifying them, and to control them, or to keep down their action when their demands are inordinate or obstructive to the attainment of some higher end. Though these impulses are determinate, or point to certain objects to the exclusion of others, such determination is not the result of comparison and deliberate choice, such as is exercised by the Intellect; but it is the necessary result of the constitution of the being in whom certain propensities are implanted to the exclusion of others. Neither Instinct nor Intellect causes the determination to one kind of food rather than another, or the preference of one class of sounds to another; we can only say, that the palate and the auditory nerve are so constituted as to give pleasure in the one case, and pain or disgust in the other. Such preferences and dislikes are no more indications of thought and purpose on the part of the animals which feel them, than is the persistent pointing of the magnetic needle to the poles, when compared with the indifference of unmagnetized needles as to their position. Mere affection attaches the human mother to her child, or the bird to her own offspring, rather than to the young of other animals; and, the attachment existing, reflection or Instinct teaches it *how* to feed and protect them. In like manner, sympathetic or unconscious imitation, which has been classed with the propensities, is also common to man and the brute, and is equally irrational or independent of thought in both. Thus, to borrow an example from Adam Smith, when a rope-dancer is performing a perilous feat, the spectators writhe and twist their bodies, accommodating their motions to what they suppose to be necessary for the acrobat's safety. And the amount of this sympathetic action is proportioned to the *absence* of thought, or to the degree in which they give themselves up to the impulse of the moment. If they are cool enough to reflect on the nature of the case and the proprieties of the occasion, they sit still. So the monkey, the parrot, and the mocking-bird spontaneously and blindly repeat movements and sounds, the purpose and meaning of which they are certainly ignorant of. The parrot can easily be taught to articulate, but not to talk, — that is, to utter words at the right moment through a perception of their meaning. Man can imitate rationally, or with a distinct cognition at the moment of the purpose to be obtained by the repeated act; but the monkey cannot.

If those mental endowments which have now been shown to be possessed in common by the human, and at least a part of the brute creation, be examined, in order to discover, if possible, some criterion or general characteristic whereby they are distinguished both from Instinct and Intellect, it will appear that the former, so far as they are exercised by the lower animals, relate only to particular cases and individual objects, while Intellect necessarily involves some power of generalization, and of drawing inferences from general principles. To adopt a distinction familiar to psychologists, the former are concerned only with *Intuitions*, while the latter requires the exercise of *Thought*. Animals can *judge* only of the object that is actually before them. This or that one thing they can perceive, remember, like or dislike, associate with some other one thing, and judge whether it will satisfy a present want. But they cannot form classes of things; they cannot generalize their experience, and thus form premises from which general conclusions can be drawn. This would be to exercise *Reason* properly so called; and Reason is a function of Thought. Consequently, animals cannot *consciously* combine means for the attainment of a future object, and therefore their modes of operation are never altered or improved. They cannot even anticipate the future, or foresee future wants; for this can be done only through a generalization of past experience.

This theory explains at once the most striking deficiency of the lower animals, —.their incapacity of using language. As they have only Intuitions, the only words which they can apply or understand are Proper Names, — the appellations of this or that particular thing. These they *can* understand. A dog can easily be taught to recognize the name of his master, even when pronounced by another person. They can even be taught to recognize the names of particular places and buildings, so that they will understand and obey when they are told to go to *the barn*, *the river*, *the field*, or *the house*.* But it is always *the particular barn*, or other object, with which they have been taught to associate this sound or significant gesture as its Proper Name. Carry the animal to a distant place, near which may be a set of corresponding objects, and then tell him to go to *the barn* or *the river*, and he will not understand the order as applying to the new set of objects, but will set off immediately for the old building or place with whose Proper Name alone he is familiar. In like manner, they can be taught by a particular word, or gesture, to repeat a certain movement, or perform a particular act, as when ordered to bark, to lie down, to watch, or to go out; by frequent repetition, the sound of this particular word has become to them the Proper Name of this particular act, the union of the two being a simple association, like that which connects a rod with the idea of a whipping. But of course, with Proper Names only, we could not frame a sentence or express any connected meaning. Words, properly so called, are *general names*, expressive of Thoughts, or whole classes of things; and brutes have no Thoughts to express, this being the peculiar attribute of Reason.

Now, as Intuitions alone will not enable animals either to foresee future emergencies, or to combine means so as to provide for them, there must be some provision to remedy this deficiency, or the different races would speedily became extinct. Habitations must be constructed; food must be procured by complex contrivances of nets and stratagems; supplies must be stored up against an approaching winter; elaborate provision must be made for the birth and nurture of offspring. Man is endowed with Intellect, which fully answers all these exigencies. The uniformity of nature's laws makes the observation of the past a mirror which images the future; and the same generalization of experience through the power of Thought enables him to combine the necessary means of satisfying the wants thus foreseen. The gift of language, which, as has been shown, is a consequence of the endowment of Thought, multiplies indefinitely the instructive power of individual experience, by making it virtually coextensive with the multiplied and various experience of the whole race. Instruction is the communication of other people's experience and the results of their ingenuity, and Intellect is entirely dependent upon instruction and personal observation. Without their aid, or without the uniformity of nature's laws, which lends them all their efficiency, it would be powerless as a means of providing for the future.

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* In Mr. Lockhart's amusing account of Sir Walter Scott's first favorite dog, Camp, he says: "As the servant was laying the cloth for dinner, he would address the dog lying on his mat by the fire, and say, 'Camp, my good fellow, the Sheriff's coming home by the ford, — or by the hill,' and the sick animal would immediately bestir himself to welcome his master, going out at the back door or the front door, according to the direction given, and advancing as far as he was able."

Instinct is an impulse, conceived without instruction and prior to all experience, to perform certain acts, which, in themselves considered, are not immediately agreeable to the agent, but are generally laborious and even painful, and which are useful only as means for some future end, this end being commonly one of pre-eminent importance or necessity, either for the preservation of the animal's own life or the continuance of its species. Instinct appears in the accomplishment of a complex act, (the building of a nest, net, or cell, or the capture of prey by a stratagem,) which man certainly could not perform without Thought, or Intellect properly so called; that is, without experience or instruction, the observation of effects, the induction of a rule or law from them, and the consequent choice and adaptation of means to ends. It has been said that man is not *more* intelligent, but *otherwise* intelligent, than the lower animals. This is hardly correct, for animals, properly speaking, are not intelligent at all. As has been shown, they are incapable of Thought. Instinct appears in them as a substitute for Intellect, not as a lower degree of it. Both the human and the brute creation have Intuitions; but these Intuitions being wholly insufficient to answer all the exigencies of either, they are supplemented, in the one case, by Thought acting through experience, and in the other, by Instinct, which is altogether independent of experience. Within its narrow sphere, Instinct is certainly superior to Intellect; for it is infallible, and the perfection of its work man cannot imitate. Man does his work ill, better, well; the animal always does his perfectly. But Instinct is blind, unchangeable, and narrow, or limited to a very few ends; so that the same animal, while working within its appointed sphere, often appears as a miracle of wisdom; but when forced to attempt anything outside of that sphere, it reappears in its true character as a mere brute. Intellect, on the other hand, is fallible, conscious of itself, discursive or even infinitely varied in its applications, and perfectible by small degrees. The unchangeableness of Instinct appears in this fact, that the nest of the bird, the cell of the bee, and the web of the spider are reproduced after the same form as rigorously as the flower and fruit of a plant.

If the view now taken is correct, the answer to our third question is obvious. It is impossible that Instinct and Intellect should ever be conjoined, or found to exist together in the same being, whether in the brute or in man. We cannot even imagine Reason acting without self-consciousness, or looking into the future without the guidance of experience or instruction, or making accurate and sufficient provision for future wants without foresight of those wants, and without conscious adaptation of its means to its ends. It is needless to bring together instances of curious, complex, and far-reaching instincts, such as those of the bee, the spider, and the migratory bird, wherewith to excite man's wonder. Every instance of Instinct, even the simplest, is marvellous to him, for it is incomprehensible. Man must *learn* to perform even the simplest acts by slow degrees, after many efforts, many mistakes and failures, and generally with much guidance. He must learn to walk. He must learn to select his food. He must even learn to see, for nothing is more certain than his inability, by the first use of his eyes, to determine either the distance, position, or magnitude of any object whatever. On the other hand, the newly dropped lamb or colt walks with ease, avoids any obstacles that may be in its way, and goes directly to the dugs of its dam, whence alone it can obtain its proper food. Whose hand guides it at once to this source of nourishment, when imitation would certainly lead it to crop the herbage, like its parents?

Another fact is worthy of notice as establishing a fundamental difference between these two faculties. Insects, and the Articulata generally, which have no brain properly so called, show more complex and surprising instincts than the Vertebrata; whence we infer that Instinct is independent of a brain, while Intellect certainly exists in very close relation with that organ.

The only actions of man which seem to have any claim to be considered as instinctive, are those prompted by the feeling of modesty or shame. This feeling itself is not an instinct, any more than the emotions of pride, emulation, or anger. But the actions to which it points are not merely natural manifestations of strong emotion, but are peculiar and definite, as if devised by reason for the attainment of a specific purpose. All the lower animals gratify each of their appetites, as nature prompts, without stint, and without any apparent desire of cover or concealment. Man alone gratifies one of them only with every precaution of secrecy, and carefully provides a covering, not needed for the purposes of protection or warmth, for certain portions of the body. No tribe of savages has ever been discovered so rude and debased as to manifest complete indifference respecting such precautions and coverings. The adult females are always provided with some clothing, however slight, the arrangement of which indicates the purpose for which it is worn; and if, in a very few instances, adult males are found unprovided with similar coverings, there is reason to believe that extreme poverty rather than indifference is the cause of the neglect. The fact, that children under the age of puberty are often suffered to go entirely nude, also indicates the purpose of the covering. However slight the garment may be, — a mere girdle with the natives of the South Pacific islands, or a narrow cloth around the loins, as with the savages of Central Africa, — travellers relate that it is guarded with much care and jealousy, and that the removal of it seems to cause as much pain and shame as would result from entire exposure among more civilized races. Reason and experience could not have indicated to savages the necessity or propriety of this slight covering; as no reason can be assigned for it, apart from the sacred instinct by which it is peremptorily enjoined. If this be an instinct, it is one which, unlike all other instincts, does not conduce to the preservation, — that is, to the physical safety, — either of the individual or of the race. Man might live in this respect as the brutes do, and live as long and as well. Call it instinct, propensity, or what we may, the only conceivable purpose for which it was implanted in man is a moral purpose, as a safeguard for the right development of his ethical nature. Hence it is, that the entire loss of it, which sometimes results from extreme profligacy, is shown by experience to be equivalent to utter moral degradation. This view of the subject, it may be added, derives some weight from the allusion to it in the history of our first parents, whether that history be regarded as revelation or tradition. Man has no instincts to keep guard over his physical well-being; reason enlightened by experience, and stimulated by affection, is abundantly sufficient for this end. But a moral instinct, indispensable for the preservation of the purity of his life, and thus auxiliary to conscience, is his never-failing endowment.

Remarks and criticisms upon Mr. Bowen's views were offered by the President, Dr. Bowditch, Professors Wyman, Parsons, Gray, and others; — to the general purport that the distinction in kind between instinct and intellect was generally, if not universally, admitted; the instinct of the human infant to the breast was insisted on; also that the young of animals learn to walk and use their limbs, to judge of distances, &c.; and as to memory, imagination, or the power of reproducing the sensible past in mental pictures, desires and affections, such as were conceded to the higher brutes, these are desires or affections of the mind, and, if not instinctive, presuppose intelligence; and, moreover, that to concede to animals the power of comparison and simple judgment is to concede to them intellect, — since all reasoning, according to the philosophical logicians, and even perception, may be analyzed into simple judgments, — thus bringing the question to one concerning the degree of manifestation of intellect, and as to what may be superadded to simple intellect in man. To the hypothesis which denies thought to the higher brute animals, was preferred the current hypothesis, that animals think, but that man alone thinks that he thinks.

Four hundred and ninetieth meeting.

January 8, 1861. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from President Barnard of the University of Mississippi, Professor Whitney of Yale College, and Professor Hackett of Newton Theological School, in acknowledgment of their election into the Academy.

Dr. Charles Beck read a paper entitled: —

Additions to Sophocles's Glossary of Later and Byzantine Greek.

Dr. Beck introduced the subject of the *Edict of Diocletian*, issued in 301, De Pretiis Rerum Venalium. After speaking briefly of the object, the historical importance, and the discovery of six fragments (four Latin and two Greek) of this document, he adverted to the philological interest attaching more especially to the two Greek fragments, which furnish over eighty words not yet included in Prof. Sophocles's excellent and scholarly work, Glossary of Later and Byzantine Greek, and fifteen which are used in the Edict in a form or meaning not given in the Glossary. The following is a list of these words, accompanied by a brief commentary.

1. *From the Fragment of Geronthrae in Laconia.*

1. Ἀκόντιον, 15, 17. The meaning of the word is made plain by the addition *ἤτοι μάστιξ*. The word, which commonly signifies *javelin*, evidently has here the meaning of *stick* or *pole* for urging the cattle.

2. Ἀνηλωτός, 9, 6, *not nailed, not provided with nails*, a well-formed Greek word, from *ἡλωτός*, *nailed*, from the noun *ἧλος*, *nail*.

3. Ἀορβιτός, 15, 23, *not curved*, a Latin-Greek word, from *orbis* with the alpha privativum.

4. Ἄσημος, 17, 26, *without stamp* or *mark*. In the classical language it is especially applied to gold and silver; here to linen cloth. It appears, according to Mommsen, that the better kinds of flax were subject to a duty and marked with a stamp (*σῆμα*); the inferior quality not being stamped. Suidas: *ἄσημος*, ignobilis.

5. Ἁστίλιον, 14, 4; the Latin *hastile*, the shaft or wooden part of a spear. That the shaft alone is meant, is apparent from the adjective *κράνειον* and the following item, 14, 5; *ἀστίλιον ἰς κοντόν*.

6. Ἁψιδωτός, 15, 24, *joined*. It is a correctly formed verbal adjective from the verb *ἀψιδόω*.

7. Βιρωτός, 15, 28. In Latin *birotus*, *two-wheeled*.

8. Βόσιος, 8, 6, *belonging to an ox*, from *βοῦς*.

9. **βουρδών**, 14, 10, either the same as *mulus*, indiscriminately the offspring of a male ass and mare, or of a male horse and female ass; or, according to Ebrardus Betuniensis (Du Cange, s. v. *bardones*), the offspring of a male horse and female ass, while *mulus* is the offspring of a male ass and mare.

10. **Γαβάθα**, 15, 41; a *vessel.*

11. **Δελματική**, 17, 1. 6. 11. 16. 21. 26. 32, *garment*, both of men and women. The more common form is δαλματική.

12. **Διλόφιος**, 18, 46; from λόφος, *neck; τύλη διλόφια*, a bolster or pillow for two necks, i. e. two persons.

13. **Δίπελμος**, 9, 12; *bisolis, double-soled;* from *πέλμα, sole.*

14. **Δίτροχος**, 15, 31; *birotus, two-wheeled*, from τροχός.

15. **Δόρκιος**, 8, 21; *belonging to a deer*, from δορκάς.

16. **Δορμιτώριον**, 15, 26 (δωρμιτώριον,[*] 15, 27); the Latin *dormitorium*, but with a different meaning, — not a sleeping-room, but a carriage in which one can sleep.

17. **Ἔντευξις**, 7, 72; *petition to bring a suit*, the Latin *postulatio.*

18. **Καλικαρικός**, 9, 1; or καλιγαρικός. It is apparently an adjective, but whether derived from καλίκιοι, the Latin *calcei*, or from καλλίγα or καλίγιον, the Latin *caliga*, I cannot say.

19. **Κανθός**, 15, 28; *tire of a wheel;* cf. Schol. Il. 5, 724.

20. **Καράκαλλον**, 17, 80. 95, *cape.* Why Mommsen, p. 67, assumes the form καρακάλλεις, and, p. 71, *caracallis*, I do not know. See Du Cange, s. v. *caracalla.*

21. **Κάριον**, 15, 30; probably a vehicle.

22. **Κᾶρις**, 15, 29; in classical Greek the designation of a *small sea-crab*, here of a *vehicle*, probably on account of some resemblance of the latter to the former.

23. **Καρούχα**, 15, 28, the Latin, or rather Keltic, *carruca* or *carrucha, a vehicle.* See Du Cange, s. v. *caruca.*

24. **Κατῆνα**, 15, 15; the Latin *catena, chain.* Sophocles writes κατήνα.

25. **Κλεῖμαξ**, 14, 6; unless a clerical or mechanical error, it is another form for *κλῖμαξ, stairs.* Suidas: κλείμαξ καὶ κλειμακισμός, πάλαισμα ποιόν (a certain grasp or trick in wrestling.)

26. **Κνησιόναιδος**, 13, 8; undaubtedly from the root *κνάω, to scratch;* probably an instrument for scratching. Mommsen conjectures κνῆστρον αἰδοῦς.

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[*] Most probably a mistake of the stone-cutter.

27. Κνήστριον, 13, 9; probably the same as κνῆστρον.

28. Κομβαῶνες, 9, 11; the translation of the word *campagi* in the Latin text, from κόμβος, *a ribbon;* here boots or shoes fastened by ribbons. The Latin word *campagus* occurs also in another form *gambagus*, and this is derived from the Gallic word *gamba* (the French *jambe*) the joint uniting the leg and foot. See Du Cange, s. v. *gamba*, who mentions also a compound, *subgamba*, the part of the foot immediately below the gamba.

29. Κόνειλα, 15, 41; of the same meaning as γαβάθα. It may be a misspelled word, derived from κῶνος, *cone*, like κωνίς, a cone-shaped vessel.

30. Κόστα, 15, 19. From the class of words among which this article is enumerated, it is probably a part of a vehicle, and from the addition of the numeral β′, it appears that it was made and sold by pairs. I consider it the Latin word costa, *rib*, and the thing a piece of wood or prop, intended to give shape and support to the structure.

31. Κουρσώριος, 9, 14; the translation, or rather adoption, of the Latin *cursorius.* Suidas: κοῦρσωρες· οἱ διατρέχοντες. κοῦρε γὰρ τὸ τρέχε.

32. Λεόπαρτος, 8, 39; unless a clerical or mechanical error, it may be another form for the common λεόπαρδος.

33. Λύνγιος, 8, 35; probably for λύγκειος, from λύγξ, the Latin lupus cervarius, Hirſchluchs. The writing λύνγιον, if not a mistake, is to be noticed.

34. Λωράμεντον, 8, 8; the Latin *loramentum*, *leather-work*, *straps.*

35. Μελίνη, 8, 29; whether it be another form of μελής, an animal found in Egypt, or of the Latin *meles* or *maeles*, a *badger* or *marten*, it is evidently the name of an animal.

36. Μοδίολος, 15, 3; the Latin diminutive *modiolus*, which has various meanings, and among them that which it seems to have here, viz. *hub.*

37. Μουλιωνικός, 9, 5; the Latin *mulionicus*, *belonging to a muleteer.*

38. Ὀβιφέρι, 8, 25; the Latin *ovifer*, even the Latin form of the genitive being retained, a *wild sheep*, πρόβατον ἄγριον. See Du Cange, s. v. *ovifer.*

39. Πείλιος, 8, 15; another form for πῖλιος, *hat;* the Latin *pileus*, which is again derived from πῖλος, *felt.*

40. Περιφορινωνοικός, 9, 20; the reading is extremely doubtful; Le Bas conjectures περιφορίνων ἢ καὶ, a very plausible conjecture. The word would be a compound of περὶ and φορίνη, *a thick, stout skin*, and

signify a shoe made entirely, all round, of stout leather. From the same stock there is a verb φορινόω, *to cover with stout leather.*

41. Πίβρατος, 7, 76; the Latin *privatus*, with a singular transposition for πρίβατος, probably a clerical or mechanical error, as the word πρίβατος occurs in other writers. (See Sophocles's Gloss.) Suidas: πρίβατον, Ῥωμαία ἡ λέξις.

42. Πουβλικάριον, 8, 43. This word is probably the result of a double mistake. The clerk who wrote the Latin original wrote *pulvicare* for *pulvinare* or *pulvinar;* and the Greek translator translated it by πουβλικάριον, which might be a later word transplanted from the Latin as well as πούβλικος and πουβλικίζω of the same stock.

43. Ῥάδις, 15, 5, a *spoke*, the Latin *radius*.

44. Ῥαῖδα, 15, 26, the Latin, or rather Gallic, *rheda*. Sophocles writes ῥαίδα.

45. Ῥῆγλα, 15, 13, the Latin *regula*, Deichſelpflock, what in the earlier Greek is called πάτταλος. Sophocles writes ῥῆγλα.

46. Σαράγαρον, 15, 23. 24. 28; the Latin *sarracum, a vehicle.*

47. Σγάλη, 14, 6; the Latin *scala*.

48. Σέγεστρον, 8, 42. 43; the Latin *segestre* or *segestrium*, a *covering of leather*, what the earlier Greek calls δέῤῥις.* See Du Cange, s. v. *segestrum*, who mentions besides the Latin *segestrum* the Greek σέγαστρον.

49. Σετιῶνες, 15, 7. Mommsen thinks it may possibly be the Latin *septiones*, meaning *the interior space of a covered vehicle*, the Latin *capsus* and the Greek ταῤῥίον.

50. Σημοδία, 15, 41; the Latin *semodius* or *semimodius*. See Du Cange, s. v. *semodius*, where he mentions the Greek form ἡμιμόδιον.

51. Στήμων, 15, 11; the Latin *temo, pole of a vehicle*, for the earlier Greek ῥυμός. In the earlier Greek στήμων signifies the warp in weaving, and the upright sticks in wicker-work.

52. Τειμή, 17, 26; for τιμή.

53. Τροχάδιον, 9, 12. 13. 14; from τρέχω.

54. Φαπιάλιον, 17, 59. 74; the later Latin *faciale*, which Du Cange, s. v. *facialis*, defines: orarium, linteum tenue, quo facies extergitur. The later Greek has a word, προσόψιον.

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* Fest. p. 70: Δέῤῥεις Graeci appellant pelles nauticas, quas nos vocamus segestria.

55. **Φαμελιαρικός**, 17, 29. 35. 56. 18, 4. 13. 34. 43. 53; in one instance φαμιλιαρικός, 17, 77; the Latin *familiaris*, *servant*, *slave*.

56. **Φασκεία**, 18, 40. 41. 42. 43; another form for φασκία, unless it be a clerical or mechanical error.

57. **Φασκία**, 18, 38. 39. 44. 45; the Latin *fascia*, *bandage*.

58. **Φασκίνια**, 18, 37; of the same origin as the preceding words; it may signify the class of articles, as distinguished from the single articles; or the superior kind of the article.

59. **Φάσκος**, 14, 7. 12; the Latin *fascis*. The later Latin *fascius* or *fascium* (see Du Cange, s. v.) may have formed the transition to the Greek form φάσκος.

60. **Φενικουλα**, 15, 21. It cannot be the Latin *feniculum*, *fennel*, as this would not suit the class of terms of which this chapter (of the woodwork of vehicles) treats. It seems to me more probable that the word is formed from *fenum*, *hay*, designating a vehicle, or part of a vehicle, used for conveying hay.

61. **Φόρμη**, 9, 1; the Latin *forma*, *last*, for the Greek καλόπους, which is mentioned in the same place.

62. **Φοῦρκα**, 15, 9; the Latin *furca*, *prop*, supporting the vehicle while the cattle are put in.

2. *From the Fragments of Karystos in Euboea.*

1. **Ἀκκουβιτᾶρις**, 16, 6; evidently a Latin word, either a change of *accubitorius* * or *accubitalis*.

2. **Ἀκκούβιτον**, 16, 6; the Latin *accubitum*.

3. **Ἀπάιος**, or ἀπάιον, 16, 90; not yet explained.

4. **Ἄφρος**, 16, 7; the Latin *Afer*, for the Greek Λιβυκός.

5. **Βαρβαρικάριος**, 16, 48; one who weaves golden threads into cloth. See Du Cange, s. v.

6. **Βλάττη**, 16, 87; the Latin *blatta*, *purple*.

7. **Γερδία**, 16, 55; *a female weaver*, for the earlier Greek ὑφάντης.

8. **Δελματικομαφε**, 16, 68; evidently a compound or derivative of δελματική, but I do not know the precise meaning.

9. **Δελμάτιον**, 16, 56; perhaps a diminutive of δελματική. See Du Cange, s. v. *dalmatium*.

10. **Δευτερεῖος**, 16, 49. 92. 95; the lengthened form for δευτέριος.

11. **Εἰμάτιον**, 16, 55; the dimiutive of εἶμα, garment.

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* Petronius 30, 11, is quoted as an instance, but the best MSS. have *cubitoria*.

12. ᾿Ενλογεῖσθαι, 16, 12; formed after the analogy of ἀπολογέομαι, but with what meaning I do not know.

13. ῾Ισγένη, 16, 94. 95. 96. 97. Mommsen suggests that it may be a corruption for ὕσγινον, *a vegetable color*, from ὕσγη, a shrub from which that color is obtained.

14. Καβαλλαρικός, 16, 5; *relating to a horse.*

15. Κοκκηρά, 16, 93; either another form for κόκκος, or it signifies the scarlet color, obtained from the κόκκος.

16. Λαδικηνός, 16, 9. 10. 11. 12. 47. 56. 74. 75. 77, for Λαοδικηνός, from Λαοδίκεια, the name of a city in Phrygia.

17. Μεταξαβλάττη, 16, 86. 98; a compound of μέταξα * (which is not a Greek, but perhaps a Persian word, meaning *silk*), and βλάττη, the Latin *blatta, purple.*

18. Μουτουνήσιος, 16, 46. 56. 71. 72. 73; or μοτονήσιος, 16, 47; according to Mommsen's ingenious conjecture, the adjective of Μουτίνη or Μοτίνη, the Latin Mutina, whose wool was highly valued.

19. Νεικαηνός, 16, 93; for Νικαηνός, the adjective of Νίκαια.

20. Νερβικός, 16, 10. 15. 76; the Latin Nervicus, relating to the Nervii.

21. ᾿Ογκία, 16, 47. 48. 49. 50. 51. 99. 100. 101; the inscription has in most of these places ὀ alone, which Mommsen, by mistake, completes into ὀγκία instead of οὐγγία or οὐγκία, the Latin *uncia.*

22. ᾿Οξυτυρία, 16, 89; probably the same as the later Latin *oxyblatta* (see Du Cange), *purple of the greatest brightness.*

23. Παραγαῦδιν, 16, 12.

24. Πεξαπρωτεία, 16, 101; evidently a compound of πέκτειν and πρωτεία; perhaps *combing or shearing of the first quality.*

25. Πεξουτός, 16, 55; *shorn;* perhaps a verbal adjective from a form πεξόω.

26. Πλουμάριος, 16, 44; the Latin *plumarius, embroiderer.*

27. Πλούμαρσις, 16, 8; from πλουμάριος; it is formed like a verbal noun, as if there were a verb of the same stock; *embroidery;* for the Greek ποικιλία.

28. Πρωτεῖος, 16, 48. 52. 94; *first.* The noun τὸ πρωτεῖον, occurring in earlier writers, presupposes the existence of this adjective, although it does not occur in earlier writers.

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* See Du Cange, s. v. *metaxarii,* with its two very different meanings, *sericorum negotiatores* and *qui rebus venalibus imponunt metam pretii.*

29. Ῥειπήσιος, 16, 78; for Ῥιπήσιος, derived from the Latin *ripa*, and intended for a translation of the Latin *ripensis*, referring to Dacia ripensis.

30. Σηρικάριος, 16, 52; the Latin *sericarius*, for the Greek σηρικοπλόκος, *silk-weaver*.

31. Σκειπάζω, 16, 6; for σκεπάζω.

32. Στίχη, 16, 45; *tunic;* perhaps from the Latin *stica*, of which there is also a form *stigium*. See Du Cange.

33. Συψηρικόν, 16, 52. 100; the Latin *subsericus*, *not entirely of silk*.

34. Τάπης, 16, 2. 4. 5. 6. 7; used in these places as a masculine instead of a feminine.

35. Ταυρογαστρικός, 16, 78; from ταυρογάστωρ. Mommsen supposes the word to express the shape of the garment.

36. Ὑποβλάττη, 16, 88; according to analogy *somewhat scarlet, light scarlet.*

37. Φιβουλατόριον, 16, 73. 74; the Latin *fibulatorius*, from φίβουλα, the Latin *fibula, buckle, a garment fastened by a buckle.*

Professor Goodwin read the following paper on the relations of the Greek Optative to the Subjunctive.

From the time of the Alexandrian grammarians a special mood, called the Optative (ἔγκλισις εὐκτική), has been recognized in Greek as distinct from the Subjunctive (ἔγκλισις ὑποτακτική). The ancient classification has been called in question in later times, and many grammarians of high authority have adopted or favored a union of the Subjunctive and Optative in one mood, to be called the Subjunctive or *Conjunctive*, in which the Subjunctive (commonly so called) is to supply the primary tenses, and the forms commonly assigned to the Optative the secondary tenses. Thus the Present Optative would be called an *Imperfect* Subjunctive; ποιῶ and ποιοῖμι, for example, being supposed to bear the same relation to each other as *faciam* and *facerem* in Latin.

This was first reduced to a systematic form by Kühner, who, indeed, discards the common names Subjunctive and Optative (except as explanatory terms), and adopts the cumbrous expressions "Conjunctive of the primary tenses" and "Conjunctive of the secondary tenses." His views have become widely known in England through Jelf's Grammar, based on the larger work of Kühner, and still more in America through the Andover translation of Kühner's School Grammars. Rost, in his *Griechische Grammatik*, § 118, says: "The so-called Optative is nothing but a peculiar form of the Subjunctive, and stands to the Greek Subjunctive in the same relation as in other languages the Imperfect and Pluperfect Subjunctive to the Present and Perfect." Donaldson in his New Cratylus (p. 617, 2d ed.) says: "It has long been felt by scholars on syntactical grounds, that, considered in their relations to each other and to the other moods, they [the Subjunctive and Optative] must be regarded as differing in tense only." Again (p. 618): "These moods have no right to a separate classification." Crosby, in his Grammar, § 591, says of this classification, that "it deserves the attention of the student, although it is questionable whether it is best to discard the old phraseology."

As the classification of Kühner has thus been introduced into no small proportion of the elementary grammars used in our schools, so that many boys are now taught to call the tenses commonly known as the Present and Perfect Optative by the strange names of *Imperfect* and *Pluperfect Subjunctive*, the question becomes not merely of theoretical, but eminently of practical importance. In fact, it meets every scholar, and more especially every teacher of Greek grammar, the moment he reaches the paradigm of the regular verb. If it were merely a question of convenience, therefore, it would be highly important to have it settled, for the sake of uniformity.

The question, *What shall constitute a distinct mood in any language?* must be settled to some extent arbitrarily. No precise rule will meet all cases; yet we may safely maintain, that when any series of verbal forms, in which the chief tenses are represented, exhibits a closer connection in form and use among its members than it bears as a whole to any corresponding series, it is entitled to the rank of an independent mood. That this is true of the Latin Subjunctive is clear; and it is equally clear that the Imperfect and Pluperfect of that mood have sufficiently strong bonds of connection with the Present and Perfect to prevent them from being marked off as a distinct mood. A merely superficial view of the relation of the Greek Subjunctive and Optative might lead us to the idea, that the two combined would form a mood similar to the Latin Subjunctive, thus simplifying the Greek conjugation and introducing a new analogy with the Latin. But it is this fatal error of carrying the analogy between the Greek and Latin further than the connection of the two languages warrants, which has thrown this whole subject into confusion. When the Latin was looked upon as an offspring of the Greek, as the result of a union of the Aeolic dialect of Greece with barbarian languages in Italy, the presumption was decidedly in favor of such an analogy, and it would even have required strong proof to convince us of any radical difference in the modal systems of the two languages. But the more correct views now entertained of the origin of the Latin would rather lead us to believe that each language developed its syntax, and especially its modal system, independently. The modal system of the parent language of the Indo-European group is of course hopelessly unknown; and yet the comparison of the Latin and Greek verb with the Sanskrit (as the oldest representative of the family) sometimes enables us to determine special points in regard to the primitive forms with an approach to certainty. Thus, to take the simplest case, when we find *asti* in Sanskrit meaning *is*, we may be sure that some similar form existed with that meaning in the parent language of the Sanskrit, the Greek, the Latin, the German, &c., from which *ἐστί*, *est*, *ist*, &c. were derived. So when we find a Potential mood in Sanskrit, which presents striking analogies both to the Greek Optative and to the Latin Subjunctive, and furthermore find the analogy extending even to the Gothic, we must conclude that the primitive language contained the elements which the Greek developed into its Optative, and the Latin into its Subjunctive. (See Bopp's *Vergleichende Grammatik*, II. pp. 257 – 259.) Again, the absence in later Sanskrit of any form corresponding to the Greek Subjunctive might give rise to the conjecture, that the Greek developed that mood by itself; but in the Vedic dialect a few relics are found of a true Subjunctive, with a long connecting-vowel as its characteristic; for example, *patāti*, bearing the same relation to the Present Indicative *patăti*, as *βούληται* to *βούλεται*. This seems to show that a similar mood existed in the parent language. If this testimony can be relied on, we must conclude, not only that the Latin and Greek derived the rudiments of their modal forms from a common ancestor, but that they inherited them from a period anterior to the separation of the Indian branch from the Indo-European family. We should therefore expect to find that the elements are generally the same in the two languages, but that the development is essentially different; and that the refinements in signification, for which the Greek modal forms are especially conspicuous, have been for the most part developed by each language within itself.

Let us now examine the forms themselves, to see how far a parallel can be drawn between the Greek and Latin moods. In clauses expressing a purpose or object after ἵνα, &c. we find the Subjunctive and Optative used like primary and secondary tenses of the same mood: thus, where in Latin we have *manet ut hoc faciat*, and *manebat ut hoc faceret*, we have μένει ἵνα τοῦτο ποιῇ, and ἔμενεν ἵνα τοῦτο ποιοίη. But even in this case of strongest resemblance there is no place for the Future Optative, which corresponds to the Future Indicative. Again, in clauses expressing *general suppositions* after ἐάν or εἰ, or after relatives or temporal particles, depending on verbs which denote general truths or repeated actions, a correlation of the Subjunctive and Optative is found, analogous to that of the two divisions of the Latin Subjunctive; for example, in ἐὰν τοῦτο ποιῇ θαυμάζουσιν, *si hoc faciat mirantur*, and εἰ τοῦτο ποιοίη ἐθαύμαζον, *si hoc faceret mirabantur*. Here, however, the analogy ceases, if we except certain cases of indirect question hereafter to be noticed, and a Homeric construction in relative sentences expressing a purpose, which almost disappears from the more cultivated language.

Let us turn now to the Optative in wishes; for here, if anywhere, we may look for the primary meaning of this mood. From this use it derives its name; and especially this is its only regular use in independent sentences, except in Apodosis with ἄν. Here some have been so far misled by the supposed analogy of the Latin, as to translate the Present Optative by the Latin Imperfect Subjunctive (see, e. g., Damm's Lexicon Homer. et Pind., *s. v.* ἡβάω); but a slight examination will show that the Present and Aorist Optative are here so far from being secondary tenses of the Subjunctive, that they are equivalent to the *Present* Subjunctive in Latin, and refer to the future, while the Greek Subjunctive cannot even regularly stand in such expressions. Thus εἴθε εἴην is *utinam sim, O that I may be;* εἴθε γένοιτο, *utinam fiat, O that it may happen;* whereas *utinam esset* and *utinam factum esset* correspond to εἴθε ἦν and εἴθε ἐγένετο.

In ordinary Protasis and Apodosis the same relation is seen. The four Greek forms, ἐὰν ποιῇ, ἐὰν ποιήσῃ, εἰ ποιοίη, and εἰ ποιήσειε, have only one Latin equivalent, *si faciat;* the four shades of meaning for which the Greek required four forms being thought worthy by the Latin of but one. Here therefore the absurdity of classifying the last two as secondary forms of the first two, in conformity to a Latin analogy, is especially clear. What the Latin analogy would lead us to expect as secondary forms, the equivalents of *si faceret* and *si fecisset*, can be expressed in Greek only by the Indicative. In Apodosis the Optative with ἂν is equivalent to the primary tenses of the Latin Subjunctive, and not to the secondary tenses: thus, ποιήσαιμι ἂν is equivalent to *faciam* (not to *fecissem*, which would be ἐποίησα ἄν). Here likewise the Subjunctive cannot be used in Attic Greek. This analogy between the Optative and the *primary* tenses of the Latin Subjunctive might lead us even to the view that the latter ought rather to be called an Optative, for which view there are certainly much stronger reasons than for the opposite one which we are considering. The analogy of the Sanskrit also seems to show that the Present Subjunctive of the Latin and the Optative of the Greek are descended from the same original forms.

In indirect quotations and questions the Optative is used after past tenses, each tense of the Indicative or Subjunctive in the direct discourse being then changed to the corresponding tense of the Optative. Thus, εἶπεν ὅτι ἃ δύναιτο ποιήσοι, *he said that he would do what he could*, implies that the direct discourse was, ἃ ἂν δύνωμαι ποιήσω. Here the Optative may be the correlative of the Subjunctive; but it is quite as often the correlative of the Indicative, as the Subjunctive can stand after primary tenses only when it would have been used in the direct discourse. One tense of the Optative, the Future, can never represent a Subjunctive, as that mood has no corresponding tense; but it always represents a Future Indicative. Nothing more need be said to show the absurdity of calling this tense a secondary tense of the Subjunctive. The three remaining tenses of the Optative can with no more propriety be called secondary tenses of the Subjunctive than of the Indicative, for they represent both on precisely the same principles. This is especially obvious in regard to the Aorist, which has two distinct meanings in indirect questions, — one when it represents an Aorist Indicative, and another when it represents an Aorist Subjunctive, the direct form. Thus, ἠγνόει τί ποιήσειεν may mean either *he knew not what he had done*, or *he knew not what he should do;* as the direct question may have been either τί ἐποίησα; *what did I do?* or τί ποιήσω; (Aor. Subj.), *what shall I do?* Strangely enough, this very class of sentences is supposed to furnish the most striking analogy between the Latin Subjunctive and the Greek Subjunctive and Optative combined. *Non habet quo se vertat*, and *non habebat quo se verteret*, are indeed equivalent to οὐκ ἔχει ὅπη τράπηται and οὐκ εἶχον ὅπη τράποιτο, but a single example like ἠρώτων αὐτὸν εἰ ἀναπλεύσειεν, *I asked him whether he had set sail* (Dem. in Polycl. p. 1223, 21), in which ἀναπλεύσειεν represents an *Aorist Indicative*, shows that the argument proves too much. Indirect quotations and questions therefore afford us more proof that the Optative is a secondary form of the Subjunctive, than that it is a secondary form of the Indicative.

Two tenses of the Indicative, the Imperfect and Pluperfect, have no corresponding tenses in the Optative, so that these are regularly retained in the Indicative in indirect discourse; thus *εἶπεν ὅτι ἐμάχοντο* means, *he said that they had been fighting*, i. e. *he said ἐμάχοντο.* A rare exception to the last principle shows conclusively the propriety of the names commonly given to the tenses of the Optative. The want of a tense in the Optative to represent the Imperfect Indicative in examples like the last was naturally felt as a defect; and in the Infinitive and the Participle this want was supplied by using the Present in a new sense to represent the Imperfect, the peculiar use being always denoted by something in the context. In a few instances we find the Present Optative used in the same way to supply the want of an Imperfect, the context making it clear that the tense is not used in its ordinary sense. Such an instance is found in Dem. in Onet. I, 869, 12; *ἀπεκρίναντο ὅτι οὐδεὶς μάρτυς παρείη, κομίζοιτο δὲ λαμβάνων καθ᾽ ὁποσονοῦν δέοιτο Ἄφοβος παρ᾽ αὐτῶν, they replied that no witness had been present, but that Aphobus had received the money from them, taking it in such sums as he happened to want.* Here *παρείη* represents *παρῆν*, and *κομίζοιτο* represents *ἐκομίζετο*, which would ordinarily be retained in such a sentence. Other instances may be found in Xen. Hell. VII, 1, 38 (quoted by Madvig, *Synt.* § 130); and in Xen. Hell. I, 7, 5. If now the name of *Imperfect* be given to the Present Optative in its ordinary use, when it represents a Present of the direct discourse, and is merely translated by an Imperfect to suit the English idiom, what shall we call this true *Imperfect* Optative, which really represents an Imperfect Indicative, and stands where an Imperfect Indicative is the regular form?

We see then that the Optative was used in the whole class of constructions known as *oratio obliqua*, or *indirect discourse*, as the correlative not merely of the Subjunctive, but also of the Indicative, and that it possessed the power of expressing in an oblique form every tense of both those moods in a manner of which the Latin presents hardly a trace. In fact, this use of the Greek Optative presents one of the most striking examples of the versatility and flexibility of the language, and of its wonderful adaptation to the expression of the nicest shades of thought of which the human mind is capable. This single use of the mood seems sufficient in itself to prevent any one who has any appreciation of its force from assigning to it the subordinate rank of a secondary form attached to the Subjunctive.

Some general remarks by President Felton, upon the connection of the Greek and Latin modal forms as illustrated by the Sanskrit, led Professor Agassiz to offer some remarks, expressing a general disbelief in the supposed derivation of later languages from earlier ones, he regarding each language and each race as substantially primordial, and ascribing the resemblances and coincidences of language to a similarity in the mental organization of the races. Whereupon President Felton pointed out some of the lexical and inflectional coincidences among affiliated languages, which were in his opinion utterly inexplicable upon any supposition other than that of historical relation.

Professor Bowen made some general observations on the supposed hereditability of peculiar traits of bodily and mental organization, and especially of mental disease.

There has been, he thought, an increasing tendency of late years to enlarge the number of such traits, and to insist more and more upon the certainty of their transmission. It has even been proposed to prohibit by law the intermarriage of persons who have mental or bodily defects or diseases which might be transmitted to their offspring. And as to insanity, there is too much reason to fear that persons have been actually driven mad through the fear, which has been carefully inculcated upon them, of having inherited insanity. It will be admitted, that, if there is anything which can foster and rapidly develop some latent tendency towards mental disease, it is dreading, and brooding over the dread, of that great calamity, regarded as an inevitable event, which must sooner or later happen. In the opinion of many, crime and sin are no longer imputable to individual men and women, but to what the lawyers call "the act of God," which entailed upon the offenders inevitably a wicked temper, a perverted will, or a diseased brain. The only proper name to be given to this doctrine is *physiological fatalism*. It rests upon a perversion of one of the darkest sayings of the old Jewish Scripture, that the sins of the fathers shall be visited upon the children, even to the third and fourth generation; — a seemingly harsh doctrine, though, in the meaning which was probably intended, it is certainly true; and which, at any rate, is not so terrific as that perversion of it, which teaches, that not merely the sins, but the congenital defects and diseases, implanted in us before birth, shall be visited upon our innocent offspring, not for two or three generations only, but for all future time.

Professor Bowen maintained that the assumed evidence upon which this theory rests is unscientific and unsatisfactory, and can be confronted by a great amount of testimony leading to an opposite conclusion. He began by admitting, or taking for granted, every *fact* which is commonly adduced in its support, — excluding, of course, such a statement of that fact as may involve any theory respecting its nature. Thus, it is a fact that insane persons can generally find among their ancestors, or their relatives in the ancestral line, one or more persons who also have been insane. The illogical, because hypothetical, statement of this fact is, that the former *inherited* their insanity from the latter. It is also a fact, that children often bear a certain measure of resemblance, in body, mind, or character, to their parents or grandparents; and the hypothetical statement of this fact is, that they have inherited these traits.

Now, one of three suppositions must be true;—either, 1. there is a law of nature that bodily and mental peculiarities shall be transmitted by inheritance; or, 2. there is a law that they shall not be so transmitted; or, 3. there is no law about the matter, and it is mere accident whether parental or ancestral peculiarities reappear in the offspring or not. The physiological fatalists maintain the first of these suppositions; Professor Bowen said he believed the second; but, as against the fatalists, it is enough to substantiate by satisfactory evidence the third.

The mistake of those who favor the doctrine of hereditary descent arises from the common error, — an Idol of the Tribe, as Bacon calls it, — which consists in regarding only the affirmative cases; "and though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or by some distinction sets aside and rejects." "Such is the way of all superstition," Bacon continues; "but with far greater subtilty does this mischief insinuate itself into philosophy and the sciences. . . . . It is the peculiar and perpetual error of the human intellect, to be more moved and excited by affirmatives than by negatives; whereas, it ought properly to hold itself indifferently disposed towards both alike. Indeed, in the establishment of any true law of nature, the negative instance is the more forcible of the two." Dr. Johnson pithily described this popular fallacy, when he said, that the one dream which comes to pass is remembered and quoted, while the ninety and nine which do not come to pass are forgotten. Just so, one case of an insane child or grandchild, nephew or niece, of an insane person, is quoted as proof of the doctrine of hereditary transmission; while the twenty other offspring of the same person, who never showed a trace of insanity, are forgotten. It is difficult to adduce evidence on this point; for while it is comparatively easy to trace back the pedigree of a madman, and find insanity somewhere in his family, either in the direct or collateral line, since statistics prove that at least one out of a thousand in the whole community suffer more or less from this disease, — it is not so easy to trace the line forward, to lay bare the history of a whole family, and to prove that no one of them, at any time or in any degree, has suffered from insanity. Only in the case of a prominent historical family, where all the facts are on record, or are generally known, is such evidence attainable.

Fortunately, there is one case of this sort that bears directly on the question. George III. may be said to have been constitutionally insane, the malady breaking out several times in the course of his life with great violence. In 1788, in 1801, and again in 1804, the disease appeared, each attack incapacitating him for the exercise of his royal functions for several months. In 1810, there was a fourth and final attack, the disease then darkening into hopeless imbecility, and continuing for ten years, the remainder of his life. It is now stated, also, though the fact was not divulged in his lifetime, that he had an earlier attack, in 1764, when for some weeks he was under restraint. But if we trace back his lineage for six generations, as far as James I. of England, not one of his ancestors can be found to have ever suffered from this complaint. Besides, he had seven brothers or sisters, and seven uncles or aunts; and as several of these married and had families, he had a goodly number of cousins and of nephews or nieces. Yet it does not appear that one of these ever showed a trace of insanity. Evidently, then, George III. did not inherit the disease. Did he transmit it? Here the evidence is equally abundant and satisfactory. This insane king had fifteen children; and as many of these had families, either legitimate or illegitimate by English law, there was a crowd of grandchildren. The Duke of Clarence alone had, by Mrs. Jordan, ten children. A very hurried search will enable one to enumerate 15 children, 22 grandchildren, and, including the children of the present Queen, 18 great-grandchildren, — say, in all, 55 descendants. Yet in this large number there does not seem to have been *one* undoubted case of insanity; and as kings and princes live in glass houses, if there had been one such case, we should probably have heard of it. Not one *undoubted* case, we say; for there is a doubtful one. The oldest of the FitzClarences, created Earl of Munster, committed suicide in 1842; and as he had shown great despondency for six weeks before his death, so that a physician was at last called in, a coroner's jury, if one had sat in his case, might have brought in a verdict of insanity; and the physiological fatalists, remembering his grandfather, would probably have called it a case of hereditary insanity, overlooking the fifty-four other descendants of George III., who have appeared as sane as other people.

One such example as this of George III. appears conclusive against the doctrine of the necessary hereditary transmission of mental disease. We thus exorcise the terrific phantom which, as already said, has probably driven many persons mad. There is more than one prophecy, the mere announcement of which has caused its own fulfilment. But the case is not a solitary one. Observation among the families of his own acquaintance, Professor Bowen remarked, *always made on the principle of collecting the negative as well as the affirmative instances*, had satisfied him, that the rule — that is, the law of nature — is *against* the hereditary transmission. If there are apparent exceptions, the *majority* of the descendants manifesting the same disease as the parent or ancestor, they are explicable through the action of sympathy, unconscious imitation, or exaggerated fears proceeding from the cause just mentioned. Cases enough can be cited of the recurrence of the phenomenon from such causes, wherein the persons concerned were not related by blood, so that inherited disease was out of the question.

Thus, up to 1839, there had not been for sixty years a case of suicide by precipitation from the top of the London monument. In that year, a young woman named Moyes threw herself off from it and was killed. Within three months, a boy only sixteen years old, whose previous conduct had shown nothing unusual, jumped off with the same result. To prevent another case, the keeper was required to accompany every person who ascended the stairs. But before the year was ended, another young woman, never before thought to be insane or to have any cause to wish for death, contrived to elude him by going to the other side of the balcony, where she also jumped off and was killed. Then, at last, the iron railing of the balcony was carried up and united to the stone work above, making a sort of cage which had no exit except by the stairs.

If these three suicides had been brothers and sisters, their case would have been put down as a strong instance of family insanity. Then may not the repetition of suicide or other insane acts by members of the same family be the result of this sympathetic propensity, or blind imitativeness, roused into keener action by the example being set near home, rather than the result of inherited mental disease? If so, how forcible is the lesson that we ought in every way to discourage and disprove this doctrine of the hereditability of insanity! Other cases are not wanting. One was reported to the Paris Academy of Medicine, that, a soldier at the Hôtel des Invalids having hanged himself on a post, his example was soon followed by twelve other invalids, and only by removing the fatal post was the suicidal epidemic at last arrested.

Thus far we have treated only of insanity. But the question is a broader one. Do any peculiarities of mental or bodily organization, appearing for the first time in one generation, tend to perpetuate themselves by the law of hereditary descent? Besides the *specific* traits, which every animal has in common with the species to which it belongs, it has also *individual* traits or peculiarities, always prominent enough to enable us easily to distinguish every individual from its fellows of the same kind, even if they are the offspring of the same parents, and sometimes so strongly marked as to deserve the name of monstrosity or disease. Does nature tend to perpetuate or efface this distinction between specific and individual traits? The question is one of great importance and the highest generality, affecting the basis of zöological science. If this distinction is feebly marked and transitory, then there is no fixed system or plan in the animal kingdom, and nothing for science to do except to chronicle a succession of fleeting peculiarities and shifting boundaries. If, on the other hand, the distinction is broad and stable, if what Blumenbach calls the *nisus formativus* necessarily tends to perpetuate the species by restricting the law of hereditary transmission to the specific traits, and excluding it from the individual peculiarities, then the dominion of law, the unchangeable purposes of the Creator, extend alike over the inorganic and the organic kingdoms, and nature becomes one consistent, permanent, and intelligible whole. Undoubtedly apparent exceptions occur, through a complexity of circumstances which science cannot always unravel. Sometimes a specific trait is wanting, and the result is a monstrosity, a *lusus naturæ;* but nature takes care to kill out such monsters, usually in the first generation. Sometimes an individual peculiarity of the parent, not so strongly marked as to deserve the name of a monstrosity, reappears in the offspring. But such cases are infrequent, exceptional, and, at the utmost, not continued beyond two or three generations. They are casual repetitions, such as are always possible in the perpetual shifting and shuffling of individual traits; they are not the results of hereditary transmission. Otherwise,—if a law of nature favored the transmission,—all individual peculiarities would successively disappear, being merged in specific traits, and each new birth would present successively a more perfect copy of its parent, until at last, all differences being effaced, individuals of the same species could no more be distinguished from each other, than a heap of silver coins freshly struck from the same die at the mint. But God's creative processes are not thus mechanical; infinite variety, no less than perfect order, is a law of nature.

The first argument, then, against the doctrine of hereditary resemblance, is founded on this admitted fact of the marvellous variety in nature. Among millions of human faces, no two can be found so nearly alike as to be mistaken one for another. All judicial inquiries, all property in animate beings, rest upon the universal recognition of this fact. Otherwise, a jury could never be satisfied that *this* man is the horse-thief, and *this* horse is the very animal that he stole. Herein is one striking difference between the organic and the inorganic kingdoms; that whereas, in the latter, the laws of nature work with absolute uniformity, the typical form, the typical act, being always exactly reproduced; in the former, the organic kingdom, the operation of the law is infinitely varied, and Nature never exactly repeats herself. As instances of the former, take the chemical composition of a drop of water whencesoever obtained, the fall of a heavy body from a height, the forms assumed by various crystallizing substances. In these cases, the similarity is perfect; man's machine-work offers but a faint copy of the marvellous accuracy of nature's action and workmanship. For an instance of the latter, take Leibnitz's challenge to his companions, to find any two leaves upon the same tree or bush, one of which should be the precise counterpart of the other. They could not. But the dividing line is strongly marked and permanent between the personal or individual traits that are thus infinitely varied, and the specific traits which are reproduced with great, but not absolute uniformity. The most striking proof that there is a law of nature prohibiting the repetition of abnormal forms is found in the fact, that, as the most fertile source of such forms is from the crossing of distinct races, nature invariably makes the product of such crosses sterile or very short-lived.

How came it, then, ever to be supposed, that nature favors the hereditary transmission of personal traits of mind, character, and external form. From the popular fallacy, already exposed, which leads the observer to fasten upon the few affirmative, to the exclusion of a crowd of negative, instances. The different features of mind and body are very numerous, and every one of them may show likeness or unlikeness with the corresponding feature in the parent. Analyze any case of supposed strong resemblance, and it will be found to consist in one or two features only, to the exclusion of six or eight others, which are wholly unlike those of the parent. Thus, a strongly marked nose, together with eyes of a peculiar shape and hue, are enough to make out what is called a marked case of family likeness; though mouth, chin, forehead, complexion, hair, outline of the face, and shape of the head may be as unlike as if they belonged to a stranger by blood; and though even eyes and nose of the same pattern may be found, almost as often as we choose to look for them, among the community at large. Again, as likeness to a grandparent is held to prove hereditary transmission just as much as likeness to the immediate parent, and as everybody has at least two parents and four grandparents, there is no cause for wonder, if, among these six progenitors within two generations, a counterpart should be found for every feature of the offspring, though accident, and not inheritance, formed the law of distribution. For, excluding malformation, there are not more than half a dozen varieties of each feature which are strongly marked enough to constitute a ground of likeness. Thus, a nose peculiar enough to be a recognized point of likeness, and yet not deformed, must be decidedly either aquiline, Roman, Grecian, flat, pug, or a *nez retroussé*. Here are but six possible forms, and according to the law of chances, we might expect to find a counterpart for any one of them among the six progenitors. It is because resemblance between parent and offspring is found much less frequently than, according to these considerations, we should have a right to expect it, even if the forms were distributed at random, or without any law at all, that we are led to believe the law of nature, if there be one in the case, favors unlikeness rather than resemblance; or that Nature *takes care to vary* her work, as she certainly does with the leaves of the same oak-tree, among which you may hunt for hours without finding two whose indented outlines are at all similar.

But supposed family likeness more frequently consists in the *general expression of the countenance*, in which respect, a large family often bear a marked resemblance to each other, while their features, taken separately, are wholly unlike. This similarity of expression, however, is not congenital, but is gradually superinduced upon Nature's work, through living together a long while in sympathy and confidence under similar influences and education, whereby, as is often remarked, husband and wife, after a long life of matrimony, come to resemble each other. And if this is the case even with adults, who come together only after age has given rigidity to the face and stereotyped its expression, how much more readily will the plastic features of infancy and children yield to similar influences and adopt the family pattern. Hence it is, that this likeness of expression generally cannot be seen in early infancy, and appears very faintly at first, but deepens and strengthens as the child advances in years. Through the same cause, also, the handwriting of the different members of the same family is often strikingly similar, though they may have learned how to write from different teachers; and probably no one will maintain handwriting to be hereditary.

All that has been said of the external features is applicable, also, *mutatis mutandis*, to traits of mind and character. The hereditary transmission of the latter is even less probable than of the former, on account of the acknowledged almost immeasurable diversity of mental traits, and because the few points of similarity can be more probably referred to the influence of education, imitation, involuntary sympathy, and other like bonds which draw together and assimilate parent and child, however originally unlike. But in spite of these causes all tending to create ultimate resemblance, we still find genius and stupidity, temper, affection, and taste so very unequally and capriciously distributed among members of the same family, that the diversities can be attributed only to nature's own ordinance established for this very purpose. Analyze any case presented as evidence of the opposite theory, and we see more plainly than ever the error of laying stress upon the affirmative points, while the negative instances are overlooked or forgotten.

Mr. George Combe cites an author who attributes the fatality which attended the House of Stuart "to a certain obstinacy of temper, which appears to have been hereditary and inherent in all the Stuarts except Charles II." But this perverse wilfulness seems more probably attributable to the education received, every Stuart being trained by a Stuart, and by an Anglican clergy then fanatically attached to the dogmas of the divine right of kings, and the subject's duty of passive obedience. Charles II. had his training in the hard school of adversity and exile, where he became more pliant. But how many other points of resemblance can be found in the succession of Stuart kings? Compare the first of them who sat on an English throne, the slobbering, pedantic, cowardly, fondling James I., with his grave, decorous, and melancholy son, treacherous as a prince, but rigidly moral as a man, and dying at last the death of a martyr and a saint. Or compare this martyr-king with his good-for-nothing though good-natured son, Charles II., or the latter with his brother, the stupid and cruel bigot, James II. Only in "the good Queen Anne," as she was sometimes called, weak and prejudiced, but motherly and fondling, and much under the influence of favorites, do we find a reproduction of some characteristic traits of her great-grandfather James I. Take any other line of European kings, and as great diversities of character and ability may be found among them as among the Stuarts. On the whole, the doctrine of the hereditary transmission of mind and character may be said to be contradicted by all history, as well as by every day's experience.

The President, Dr. Bigelow, remarked that undoubtedly many of the errors in science, and still more in popular belief, arose from hasty generalization, and the acceptance of a few striking or remarkable facts, to the exclusion of a greater number of common negative or uninteresting facts, thus establishing as general rules things which were only exceptions to such rules. The medical profession, however, were agreed, as the result of general observation, that although most diseases terminate with the individual, yet that certain peculiarities, not only of bodily structure, but of tendency to disease, are transmissible by inheritance. Thus a sixth finger, near-sightedness, squinting, and peculiarities of complexion, features, and stature, are more or less transmissible from one generation to another. So also, among diseases, consumption, scrofula, gout, some eruptive complaints, nervous affections, and, to a certain extent, carcinoma, apoplexy, and insanity. The hereditary predisposition is most marked when both parents are subjects of the peculiarity or disease. Dr. Bigelow cited some cases in which, both parents having been affected with a disease, all the children had eventually died of the same disease. If procreation could be regulated by authority, he did not see why the peculiarities of individuals could not be perpetuated as races or varieties of men, as well as they now are of domestic animals. According to the nature of the transmitted peculiarity, such races would either be multiplied indefinitely, or the race would die out and disappear.

The great obstacle and safeguard against the transmission of such diseases consists in the crossing of the race or breed. Every cross effected with a healthy stock reduces the liability one half, and every second cross reduces it to one quarter, and so on. If it were otherwise, certain races would become extinct. There is probably no individual in this room, who does not inherit from some of his ancestors a title to phthisis or gout or insanity. Yet the great dilution or weakening of this title, under repeated crosses, renders the predisposition inconsiderable and ineffectual.

Mr. Ritchie exhibited a quantity of liquefied nitrous oxide, condensed by a very powerful pump, of his own contrivance, and exhibited the instantaneous freezing of mercury in the liquid, while charcoal burned with vivid ignition, as in oxygen gas, at its surface.

The President read the following letter from the venerable Josiah Quincy.

TO JACOB BIGELOW, M. D., *President of the American Academy of Arts and Sciences.*

SIR, — I shall be obliged if the Academy will so far deviate from their usual practice as to anticipate their regular time of meeting in February next, and, instead of the 12th, assemble at my house on the evening of the 4th of that month, on which day I enter my ninetieth year.

The occasion is peculiar, and not likely soon to recur again, or to be drawn into a precedent. To me "the silver cord is not yet loosed," though much frayed and life-worn, and the favor will be to me a gratification and rejuvenescence.

With perfect respect, I am yours, &c.

JOSIAH QUINCY.

BOSTON, January 8, 1861.

Whereupon it was unanimously voted that the invitation be accepted, the letter placed upon the record of the present meeting, and that the officers of the Academy communicate to President Quincy the expression of the extreme interest of the Fellows of the Academy in the occasion which prompted this invitation, and their most cordial acceptance of it.

Four hundred and ninety-first meeting.

January 30, 1861. — STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from the Hon. G. M. Dallas, the American Minister at London, enclosing a copy of correspondence with Lord John Russell, Secretary of State, and announcing the liberal donation by the British Government to the American Academy, of a complete set of the Geological Maps and Sections of the Survey of the United Kingdom of Great Britain.

Mr. J. E. Oliver, of Lynn, was elected a Fellow, in Class I. Section 1.

Professor Peirce presented the results of an investigation of the phyllotaxic numbers and their relations.

President Felton gave an account of the progress that had been made, and the results attained, in unrolling and deciphering the Herculanean manuscripts.

Dr. C. T. Jackson exhibited specimens of eocene tertiary coal from the Isthmus of Darien, near Chiriqui, similar in character to cannel coal, although of so much more recent formation.

Mr. Newcomb presented the results of an investigation of the dynamical theory of gases.

One of the most beautiful hypotheses ever propounded in physics is that which has lately been known as the dynamical theory of gases. This theory supposes a gas to be composed of isolated particles, moving about in every direction with great velocity, and continually striking and rebounding from each other. The expansive force is due to collisions against the sides of the containing vessel. The temperature depends upon the rapidity of the motion, being represented by the *vis viva* of the separate molecules. This theory has therefore a very intimate relation with the mechanical theory of heat, and is in part dependent on it. The truth of such a theory must be judged of from the agreement of the results deduced from it with observed phenomena. The following physical laws and properties of gases follow from this theory.

1. Mariotte's law.

2. Equal volumes of all gases set free the same amount of heat when compressed by the same fractional part of their volume, this amount being the exact mechanical equivalent of the force employed in producing the compression. Hence, if the compression is considerable, the amount of heat will vary with the rapidity of the compression, being much greater when the whole amount of heat set free is confined in the gas, than when it is suffered to escape as rapidly as it is formed.

3. Gases expand equally for equal increments of temperature.

4. Equal volumes of all gases, measured at the same temperature and pressure, contain the same number of particles.*

5. Gases will diffuse into each other in accordance with the following laws.

a. Gases at the same temperature and pressure will diffuse into each other with a velocity directly as the square root of the specific gravity, when measured by the *mass* which is diffused, and therefore *inversely* as the specific gravity when measured by volume.

β. The temperature of the gas being increased, while its volume remains constant, the diffusive power will increase as the square root of the elasticity.

γ. The temperature varying, while the pressure remains constant, the diffusive power will vary inversely as the volume.

Or, in general, gases diffuse into each other according to the laws which regulate their flow into a vacuum.

6. A body moving rapidly through a gas will be subject to an increase of temperature, varying as the square of its velocity. For different gases this increase will be directly as the specific gravity of the gas; but the effect of radiation being eliminated, the increase of temperature will in the case of the same gas be independent both of the temperature and the density of the gas.

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* Maxwell, Philosophical Magazine, January, 1860.

7. If the particles were perfectly hard and spherical, the specific heat under constant volume would be to that under constant pressure as 3 to 5. If they were hard, but not spherical, this ratio would be that of 3 to 4. The latter result follows from an elegant theorem given by Professor Maxwell in Vol. XX. of the Philosophical Magazine; viz. that if the particles are hard, but not spherical, the sum of their *vires vivæ* of translation will be equal to that of their *vires vivæ* of rotation. Unless it can be shown that this ratio will be lessened by supposing that the non-spherical particles are not hard and unyielding, which certainly seems improbable, this result will present the greatest difficulty which the theory has to encounter.

Considering the number and variety of the phenomena of gases which are accounted for on this theory, and especially the exactness with which it accounts for the hitherto inexplicable phenomena of diffusion, there seems to be a considerable probability in its favor. The small discrepancy between the observed and computed ratio of the specific heats (1.42 and 1.33) may be found to proceed from some property of the particles not taken account of in the mathematical analysis.

The laws of diffusion are obtained on the hypothesis that the gases are separated by an exceedingly thin partition, pierced with extremely small holes. The change of temperature produced by motion proceeds from the changed velocity of impact of the particles against the body, each molecular impact producing a heat-wave.

Professor Gray presented the following papers: —

1. *Characters of some Compositæ in the Collection of the United States South Pacific Exploring Expedition under Captain Wilkes, with Observations*, &c. By ASA GRAY.

Vernoniaceæ.

MONOSIS INSULARUM (sp. nov.): fruticosa, laxe ramosa; foliis oblongis acuminatis repando-dentatis basis cuneatis in petiolum attenuatis puberulis supra glabratis subtus ad costam venasque cum ramis adpresso-tomentellis; capitulis corymbosis; pappi setis rigidis vix denticulatis, majoribus apice clavellatis. — Tonga and Feejee Islands. A true congener of *M. Wightiana*, DC., the type of the genus, which stands in nearly the same relation to *Gymnanthemum* that De Candolle's section *Eremosis* does to *Vernonia*.

Albertinia Brasiliensis, Spreng. To this belongs Gardner's *Vernonia platycephala*, and Nuttall's *Symblomeria Baldwiniana.*

Paranephelius uniflorus, Poepp. & Endl. Of this three varieties may be recognized, viz. *α.* pinnatifidus, *β.* bullatus (*P. bullatus*, Gray, Wedd. Chl. And. 1, p. 214), *γ.* ovatus (*P. ovatifolius*, Gray, ined. *P. ovatus*, Wedd. l. c. t. 37), which Weddell as well as I myself had distinguished as species; but an attentive examination of various specimens leads to the conclusion that they are all forms of one.

Liabum lyratum (sp. nov.): herbaceum; foliis supra hirsutiusculis glabratisve subtus arachnoideo-tomentosis, caulinis lyrato-lobatis petiolis basi auriculatis plerumque connatis, summis sessilibus basi dilatata connatis, lobo terminali maximo subinciso et repando-denticulato; pedunculo terminali elongato mono-oligocephalo; involucri squamis oblongis substriatis; pappo e setis paleolisve rigidis inæqualibus, exterioribus dimidio brevioribus. *Alibum liaboides*, Less.? — Obrajillo, Peru: also collected by Matthews, no. 3057. If this proves to be the *Alibum liaboides* of Lessing, that genus cannot stand upon the characters indicated. For, as well as can be told from imperfect specimens with the heads injured by insects, the pappus is similar in the disk and ray, the exterior not really coroniform; and the plant nearly accords with *Liabum*, in the extended sense, or with *Andromachia* § *Pleionactis*, DC., except that the bristles of the pappus are more stout and rigid, and also fewer. They are fragile and deciduous, when the summit of the achenium appears somewhat like a short crown.

Eupatoriaceæ.

Conoclinium subglutinosum (sp. nov.): glabrum; caulibus basi suffruticosis; foliis longe petiolatis late deltoideo-ovatis acuminatis serratis membranaceis tripli-quintuplinerviis utrinque subglutinosis; corymbo polycephalo; involucri squamis 10-13 dorso subglutinosis bicarinatis, exterioribus ovatis, intimis spathulatis acutis; achenio glaberrimo. — Brazil, at the base of the Organ Mountains, near Rio. This may be somewhere described as an *Eupatorium*, but I do not identify it with any published species. The receptacle is acutely conical.

Asteroideæ.

VITTADINIA, A. Rich.

Char. emend. Capitulum multiflorum, heterogamum; fl. radii uni-pluriserialibus fœmineis, disci (pluribus paucisve) tubulosis hermaphroditis. Involucrum obconicum seu hemisphæricum, imbricatum, pauciseriale, squamis inæqualibus angustis appressis. Receptaculum planum, nudum, pl. m. alveolatum. Ligulæ parvæ, tubo suo fere semper breviores, nunc exiguæ stylo ipso breviores. Corollæ disci tubulosæ, 4 – 5-dentatæ. Antheræ *Euasterinearum*. Styli rami fl. herm. superne elongato-subulati hirtelli. Achenia compressa, striata, vel 4 – 6-costata, vel tantum marginato-bicostata lateribus enerviis, apice sæpius contracto, disco epigyno parvo. Pappus simplex, conformis, e setis capillaribus scabris uni – pauciserialibus. — Suffrutices vel herbæ Oceanicæ, caulibus ramosis plerumque foliosissimis, foliis alternis. Capitula aut solitaria ramos terminantibus aut corymbosis: ligulæ abæ vel purpureæ.

Vittadinia, A. Rich. Bot. Voy. Astrol. Fl. N. Zel. (1834), p. 250.
Tetramolopium, Nees, Ast. (1833), p. 202, pro parte.
Vittadinia, *Tetramolopium* § 1 & *Eurybiopsis*, DC. Prodr.

De Candolle's *Eurybiopsis* is essentially identical with the older *Vittadinia* of A. Richard, and has been referred to it by Dr. Hooker. The only observed difference is, that the faces of the achenium of *Eurybiopsis macrorhiza*, if I rightly identify the plant, are nerveless; those of *Vittadinia* are striate-nerved. There must, however, now be added to the genus several Hawaian species, one of which is strictly an *Eurybiopsis;* another, the type in part of *Tetramolopium*, Nees, differs only in its less copious uniserial pappus, and in the shorter, mostly four-ribbed achenia; while others, with corymbose and still smaller heads, have decidedly pluriserial rays, with their more reduced ligules sometimes even shorter than their styles, and the hermaphrodite flowers fewer, — in one instance even reduced to unity, — so that these are to *Vittadinia* proper what the Conyzoid Erigerons are to *Stenactis* or to true *Erigeron*. The genus, thus augmented, while by its larger-flowered species nearly related to *Eurybia* (from which De Candolle and Dr. Hooker remark that it technically differs only in its compressed achenia), and nearly congruous with the group of ambiguous Asters designated under the name of *Orthomeris* by Torrey and Gray, is now seen, on the other hand, to be the analogue of *Erigeron*. From the latter already too polymorphous genus, *Vittadinia* would be well distinguished by its striate or ribbed achenia, and the slender subulate tips of the styles, except that, unfortunately, some of the species show neither facial ribs nor striæ, while a few species of *Erigeron*, as Weddell regards them, have long and slender tips to their styles, and some North American ones have four-nerved achenia. The habit generally is not that of *Erigeron*, and the achenia and the more imbricated involucre will distinguish those species which might otherwise be confounded with the *Cænoti*. The short, but always distinct ligules are characteristic of the genus. Most of the Sandwich-Island species are decidedly shrubby plants, those of New Zealand and Australia woody at the base; but there are two Australian species which appear to have annual roots. On the other hand, *Erigeron fruticosum* of Juan Fernandez, which forms a shrub, is apparently a genuine *Erigeron*.

De Candolle assigns uniserial rays to his *Eurybiopsis* and to the New Zealand *Vittadinia*, and bi–triserial rays to the Australian *Vittadiniæ;* Dr. Hooker regards them as uniserial throughout. When ligules are numerous and narrow, this character has neither definiteness nor significance, as the genus *Erigeron* shows. To both *Eurybiopsis* and *Vittadinia* De Candolle ascribes a "*pappus uniserialis*," a term which he seems not always to have employed in one and the same sense. In the species known to De Candolle, the very copious bristles of the pappus certainly occupy two or more ranks, just as in *Aster*. From these there is a gradual transition to the more scanty and obviously uniserial pappus of *V. tenerrima* and the smaller-flowered species of the Sandwich Islands.

For the genus, as here augmented, the name of *Tetramolopium* might be assigned in virtue of its priority, as it antedates *Vittadinia* by a year. But the former name was given to two heterogeneous species, viz. one from the Sandwich Islands, which has long remained obscure, and one from the Quitensian Andes, which is a *Diplostephium*, and with which De Candolle rightly associated two other of Humboldt and Kunth's Asters. In this case the name *Vittadinia* may fairly be kept up. The three generic names thus brought together may be retained for as many sections, characterized as follows:—

§ 1. VITTADINIA VERA. Achenia elongata, faciebus pluristriatis. Pappus copiosus pluriserialis. Ligulæ pl. m. conspicuæ. Capitula majuscula, solitaria.

V. TRILOBA (DC. non Hortul.): caule erecto e radice annua apice subcorymboso cum foliis spathulatis cuneatisve basi longe attenuatis superne trilobis vel tridentatis (ramealibus angustioribus sæpius integerrimis) scabro-hirtellis vel hirsutis; ligulis purpureis breviter exsertis; acheniis clavato-linearibus pluristriatis immarginatis pubescentibus, maturis involucro etiam pappo pluriseriali fulvo æquilongis.—Variat foliis caulinis tripartitis, lobis trifidis seu laciniatis.—Eastern Australia.—The plant which was generally cultivated in the European gardens, a few years ago, as *Vittadinia triloba*, and which Dr. Sonder, mistaking it for the genuine Australian plant of that name, has described as *Erigeron trilobum*, is manifestly De Candolle's *Erigeron mucronatum*, of Mexico and Venezuela.

V. CUNEATA, DC. (*Eurybiopsis gracilis*, Hook. f. and probably *V. dentata*, DC.) is not well named. The perennial root, undivided leaves, and less rough pubescence distinguish it from the preceding species.

V. SCABRA, DC. (*Eurybiopsis scabrida*, Hook. f. *E. Hookeri*, Sonder). Müller's plant, or at least the var. *angustifolia*, accords pretty well with the character of De Candolle's *V. scabra*. It appears to be distinguishable by the less copious and shorter pappus, and by the less attenuated achenia, which are evidently margined by ribs considerably stronger than the facial nerves.

§ 2. EURYBIOPSIS. — Achenia minus elongata, marginato-binervia, faciebus haud striatis. Pappus uni-pluriserialis. Cæt. sect. præcedentis.

V. HISPIDULA (F. Müll. ined.): undique scabro-hispida seu hispidula; caule erecto e radice annua stricto oligocephalo; foliis caulinis linearibus sessilibus imisve spathulatis paucidentatis; ligulis e pappo leviter exsertis; acheniis appresse-hirtellis obovatis apice breviter acutatis faciebus enerviis pappo fere uniseriali brevioribus. — Eastern and Tropical Australia.

V. MACRORHIZA (*Eurybiopsis macrorhiza*, DC.) if rightly identified with Dr. Müller's specimens from "Providence Hill," considerably resembles dwarf and narrow-leaved forms of *V. scabra*, but the faces of the achenia are nerveless, as in *V. hispidula*. The pappus is more copious than in the latter, and about the length of the (immature) linear achenia.

V. HUMILIS (sp. nov.): suffruticosa, e basi crassa multicaulis; caulibus foliosissimis; foliis anguste spathulatis integerrimis undique hispidis seu hirtellis aveniis, costa subtus incrassata; pedunculis brevibus solitariis vel subumbellatis; ligulis uniseriatis flores disci (6 – 12) vix superantibus stylis duplo longioribus; acheniis lineari-oblongis marginato-binervatis hirtellis estriatis pappo subtriseriali inæquali dimidio brevioribus. — Variat foliis hirsutioribus vel subglabratis, nunc fere linearibus basi longe attenuatis. — Sandwich Islands, on the mountains of Hawaii and Maui. — This species manifestly connects the original *Tetramolopium* with *Eurybiopsis*. A depressed and glabrate variety, from the district of Waimea, Hawaii, makes the nearest approach to the *Tetra-*

molopium tenerrimum of Nees, which, however, is distinguished by its smoothness as well as smaller size, the more exserted ligules, uniserial pappus, and glabrous, mostly four-ribbed achenia. It belongs therefore to the following section.

§ 3. TETRAMOLOPIUM (*Tetramolopium*, Nees, pro parte). — Achenia breviuscula, quadricostata, nempe costis 2 marginalibus validis, 2 facialibus angustioribus, his raro inconspicuis quandoque geminatis. Pappus uniserialis. Capitula nunc solitaria ligulis exsertis, nunc parva corymbosa ligulis pluriserialibus discum haud superantibus, floribus disci paucis vel paucissimis.

V. TENERRIMA (*Aster tenerrimus*, Less. *Tetramolopium tenerrimum*, Nees): suffruticulosa, glabra, cæspitoso-multicaulis; foliis in caulibus (brevissimis seu decumbentibus) confertis lineari-spathulatis uninerviis aveniis parce hispidulo-ciliatis basi longe attenuatis; pedunculis solitariis gracilibus bracteis pluribus setaceis instructis; ligulis uniseriatis discum pluriflorum superantibus tubo subæquilongis; acheniis obovato-oblongis 4–5-costatis; pappo uniseriali æquali. — Oahu, Chamisso, Macrae. The character from a specimen collected by Macrae.

V. REMYI (sp. nov.): fruticosa, corymboso-ramosissima, glabra; foliis secus ramulos confertissimis acerosis deorsum leviter attenuatis supra canaliculatis; pedunculis terminalibus solitariis elongatis puberulis bracteis parvis setaceis instructis monocephalis; involucri hemisphærici squamis lineari-subulatis margine vix scariosis; ligulis biseriatis discum pluriflorum superantibus tubo breviusculo subduplo longioribus; acheniis appresse hirsutulis obovato-oblongis quadricostatis; pappo albo uniseriali. — Maui, Sandwich Islands, coll. Remy, no. 239. — This is a shrub, at least a foot or two in height, with rigid branches squarrose with the crowded leaf-scars, the laricine leaves much crowded on the ultimate branchlets; the heads about as large as those of *V. tenerrima*. It is the only species known in which the ligules are decidedly longer than their tube. Although it is not surprising that Lessing should have failed to recognize the close relationship of his *Erigeron lepidotus* with his *Aster tenerrimus*, he would surely have associated them had he known the present species, which, with the inflorescence and the exserted ligules of the former, has the habit of the latter, especially of the variety *arbuscula*.

V. CHAMISSONIS (*Erigeron lepidotus*, Less. *E. pauciflorus*, Hook. & Arn.): fruticosa, ramosissima, glabella; ramulis corymbosis puberulis usque ad apicem foliosissimis; foliis lineari-lanceolatis seu linearibus

basi sensim attenuatis et sæpius hirsuto-ciliatis integerrimis subdentatis rariusve laciniato-incisis creberrime papuloso-punctulatis submembranaceis venulosis; pedunculis brevibus filiformibus corymboso-oligocephalis; capitulis parvis (2 lin. longis); involucri squamis lineari-lanceolatis acutis vel acuminatis; ligulis 15 – 20 tubo sub-brevioribus flores disci 5 – 10 vix superantibus stylis plerumque longioribus; acheniis obovato-oblongis parce hirtellis vel glabratis quadricostatis, costis marginalibus calloso-incrassatis, facialibus angustioribus nunc fere obsoletis raro geminatis; pappo uniseriali. — Kaala Mountains, Oahu.

Var.? ARBUSCULA: foliis secus ramulos ultimos confertissimis rigidioribus angustioribus nunc fere filiformibus; pedunculis abbreviatis; capitulis paucioribus majoribus. — On the Great Crater of the eastern part of Maui, Sandwich Islands. — This would naturally be taken for a distinct species, and may prove to be so. The heads are decidedly larger than those of *V. Chamissonis*, being three lines in diameter, and the flowers more numerous, but similar.

V. CONSANGUINEA (sp. nov.): fruticosa, corymboso-ramosissima, glabella; ramulis usque ad apicem foliosissimis; foliis lineari-lanceolatis seu lineari-spathulatis basi attenuatis et subciliatis integerrimis (raro 1 – 2-dentatis); pedunculis brevibus corymbosis mono – oligocephalis; capitulis parvis (2 lin. longis); involucri pluriseriali squamis lineari-oblongis obtusissimis scarioso-marginatis, margine creberrime denticulato-ciliato; ligulis 25 – 30 tubo subæquilongis flores disci adæquantibus; acheniis *V. Chamissonis* sed glabris. — Sandwich Islands, on Hawaii and the mountains of Kauai. Much resembles the preceding, but the involucre is more imbricated, its scales broader, very obtuse, and bordered with a more definite scarious margin, which is fringed with fine and close denticulations: the ligules are more numerous.

V. ARENARIA (sp. nov.): suffruticosa, laxe ramosa, hirtella; ramis usque ad apicem foliosis; foliis lanceolatis seu oblongo-lanceolatis basi attenuatis hirto-ciliatis integerrimis mucronatis; capitulis (3 lin. diametr.) breviter pedunculatis corymbosis; involucri squamis linearibus acutis submembranaceis; ligulis plurimis (30 – 35) tubo brevioribus flores disci 5 – 9 subæquantibus; acheniis oblongis quadricostatis hirsutulis seu glabratis; pappo uniseriali, setis inæqualibus. — Sandwich Islands, on sand-hills of Maui, and district of Waimea, Hawaii.

V. CONYZOIDES (sp. nov.): fruticosa, ramosissima, cinereo-pubescens; ramulis usque ad apicem foliosis; foliis angusto-lanceolatis basi longe attenuatis integerrimis membranaceis; capitulis minimis compluribus congestim corymbosis; involucri squamis linearibus subacutis; ligulis plurimis brevissimis pappum uniserialem adæquantibus stylis suis brevioribus; flore hermaphrodito sæpius unico; acheniis parce hirsutulis 2 – 4-costatis. — Sandwich Islands, on the sand-hills of Maui. — The facial ribs of the achenia are often obsolete. If the species which connect it with the original *Tetramolopium* were unknown, this would surely be referred to the *Cœnotus* section of *Erigeron*.

CALOTIS PALMATA (sp. nov.): hispido-pubescens; foliis cuneatis seu flabelliformibus palmato-3 – 5-fidis (nunc pedatifidis) inferne longe quasi in petiolum alatum attenuatis basi leviter auriculatis, summis linearibus oblongisve integerrimis vel apice tridentatis; involucro biseriali fere 20-phyllo; acheniis complanatis lævibus; pappo e paleis 2 – 4 et aristis 1 – 2 versus apicem parce retrorsum aculeolatis. — Hunter's River, New South Wales. An herbaceous species, with larger heads than those of *C. dentex*. Cunningham's *C. dilatata* has the awns of the pappus similarly but more sparingly barbed; but its leaves are not lobed, and the basal auricles are more conspicuous.

LAGENOPHORA PICKERINGII (sp. nov.): foliis hirsutis primum villoso-lanatis oblongis ovalibusque in petiolum attenuatis repando-dentatis; scapo gracili nudo; involucri squamis linearibus fere glabris; acheniis radii oblongo-lanceolatis erostratis insigniter costatis glaberrimis, disci sterilibus. — Mountains of Muthuata, one of the Feejee Islands. Among the largest species of the genus, the scape 6 to 8 inches high, but the head is proportionally rather small, in fruit only three lines in diameter. The achenia are coarsely striated by 8 or 10 strong and salient ribs (in a manner unknown in other species), not beaked, but terminated by an epigynous disk about the size of the basal callus.

APLOPAPPUS PŒPPIGIANUS, var. RADIATUS (*Diplopappus Pœppigianus*, Hook. & Arn., forma eradiata. *Aplopappus sericeus*, Philippi): humilis, fruticosus; foliis secus ramos breves confertissimis anguste lanceolatis rigidis utrinque attenuatis cuspidatis integerrimis undique sericeis; pedunculis elongatis nudis parce setaceo-bracteatis monocephalis; involucri hemisphærici squamis lineari-subulatis glanduloso-puberulis, apicibus squarroso-patentibus; ligulis discum vix superantibus; acheniis sericeis. — Chili, on the Andes above Santiago. The rigid, entire, silvery-silky, Protea-like leaves are crowded on the short and tufted woody branches. Head rather larger than that of *A. pulchellus.*

APLOPAPPUS MACRÆANUS, will be a proper name for *Pyrrocoma* (*Chromochæta*) *angustifolia*, DC., *P. Macræana*, Remy in Gay. Fl. Chil.?), in honor of one of its discoverers.

APLOPAPPUS PARVIFOLIUS (*Pyrrocoma parvifolia*, DC.), although nearly related to the last, is known by its smaller leaves and heads, and thinner, acutish scales of the involucre. The genus *Pyrrocoma* cannot be sustained upon the rayless heads, as De Candolle and Remy would have it; for intimately related, and even identical species are both radiate and rayless in different specimens, and the original *Pyrrocoma* has rays, as was long ago shown; the shape and the smoothness of the achenia also fail as characters; the form of the involucral scales offers no definite distinction, and the color of the pappus is of no account. That of *A. Macræanus* varies from deeply rufous to fulvous. *A.?* (*Pyrrochæta*) *Hænkei*, DC., is *Corethrogyne filaginifolia*, and was doubtless collected in California.

NARDOPHYLLUM REVOLUTUM, DC. To this belongs *Dolichogyne stæhelinoides* and *D. gnaphalioides*, DC. (*D. Candollei*, Remy). Contrary to Weddell's opinion, it seems clear that Remy's second thought (in Ann. Sci. Nat. ser. 3, 12, p. 184) was best, when he approximated *Dolichogyne* DC. to Dr. Hooker's section of *Chiliotrichum*, his genus, *Anactinia*. The wonder is that he did not combine such evident congeners. *Dolichogyne*, however, is antedated by *Nardophyllum*, Hook. & Arn. Here it is again remarkable that De Candolle, who had established the latter genus upon Hooker and Arnott's data, did not suspect its identity with his subsequent *Dolichogyne*, probably because he had ascribed to the former "antheræ basi bisetosæ" and "pappus plumosus." The anthers, like the corolla, are strictly Asterineous, and the bristles of the pappus moderately barbellate along their thicker upper part, not "plumose," as Hooker and Arnott write in their generic character, and hardly "subplumose" as they give it under the species. As to Weddell's extension of *Dolichogyne* to include (in his section *Tola*) three species with heterogamous flowers, the pistillate ones incipiently ligulate, I remark that the adoption of this view would merge the whole in a still older genus, *Lepidophyllum*, Cass., which differs only in having the ligules a little more developed (yet often bilabiate or irregularly cleft), and the pappus of stouter bristles. The leaves of *Lepidophyllum cupressiforme* are indeed opposite; but both opposite and alternate leaves occur in the nearly allied South African genus *Pteronia*; and the difference between *L. cupressiforme* and *L.*

Meyeni (*Baccharis quadrangularis*, Meyen, *Dolichogyne lepidophylla*, Wedd.) is paralleled in *Pteronia* and *Aplopappus*, &c. I should therefore propose to keep up the two genera, *Lepidophyllum* and *Nardophyllum*, and refer to the former (as above) Weddell's *Dolichogyne lepidophylla*, which he has figured, and probably his *D. rigida* and *D. rupestris*, with linear leaves. The nearest relatives of both genera (if we may distinguish them as genera) inhabit the corresponding cool and dry portion of the northern part of the American Continent, where they constitute similar features in the vegetation, i. e. are mostly social, frutescent plants on naked plains or plateaux, — Nuttall's *Chrysothamnus* (section of *Linosyris*, Torr. & Gray) strictly representing *Nardophyllum*, and his *Ericameria* being analogous to *Lepidophyllum*. Taken in connection with geographical distribution, slight characters in the pappus (though weakened in *L.* (*Chrysothamnus*) *Bigelovii*) and in the style may serve to separate the North American from the South American species. Yet in a general system and under a truer valuation of generic characters, they may well be combined. To *Nardophyllum* belongs : —

NARDOPHYLLUM KINGII the *Chiliotrichum Kingii*, Hook. f. Fl. Antarc., this being a strict congener of *N. revolutum*, and therefore the following, of which I have no specimens to examine; and which perhaps are not all specifically distinct : —

NARDOPHYLLUM HUMILE. *Chiliotrichum humile*, Hook. f. *Anactinia Hookeri*, Remy.

NARDOPHYLLUM DARWINI. *Chiliotrichum Darwini*, Hook. f.

NARDOPHYLLUM CHILIOTRICHOIDES. *Dolichogyne chiliotrichoides*, Remy. — Weddell's *Dolichogyne armata*, with the branches of the style subspatulate and obtuse, appears doubtful.

BACCHARIS GILLIESII (sp. nov. *B. paucidentata*, var. β. Hook. & Arn. pl. masc.): herbacea e bàsi lignescente, glabra, humilis; caule ramosissimo; ramis corymbosis gracilibus striato-angulatis foliosis, ultimis capitulo solitario terminatis; foliis sessilibus leviter uninerviis aveniis, caulinis linearibus basi attenuatis integerrimis seu dentes 2–4 patentes gerentibus, ramealibus parvis angustissimis; involucro campanulato, squamis oblongis obtusissimis coriaceis dorso herbaceis margine tenuiter scariosis apice lanato-ciliatis; acheniis glaberrimis; pappo fœmineo involucrum ter superante. — Rio Negro, North Patagonia: also gathered by Tweedie, and at Buenos Ayres by Gillies. One specimen in the Hookerian herbarium is ticketed *B. nana*, Don, a name which I do not propose to revive, since the stems when well developed are a foot high. It is distinguished from *B. paucidentata* by its solitary heads, and its campanulate involucre with broader and very obtuse scales. *B. coridifolia* has clustered and much smaller heads, and scabrous-ciliate leaves. — *B. juncea*, Desf., to which belongs *B. subulata*, Don, often has the stems leafy, and so lignescent at the base that the root would seem to be perennial.

Senecionideæ.

TITHONIA PUSILLA (sp. nov.): annua, hispidula; foliis oppositis subalternisve lanceolatis fere integerrimis breviter petiolatis; capitulis nudis pedunculatis; involucri squamis lanceolatis hirsutis subpaucis; acheniis villosis; pappi paleis 4 – 6 aristisque binis plumoso-ciliatis. — Obrajillo, Peru.

VIGUIERA PERUVIANA (sp. nov.): foliis alternis ellipticis seu ovato-oblongis acutatis vel mucronatis acute serratis trinervatis utrinque cinereis supra hispidulo-scabris subtus appresso-hirsutulis basi acutis subsessilibus; involucri squamis oblongo-lanceolatis apice patentibus extus præsertim ad margines albo-hirsutis; receptaculo obtuse conico; ligulis elongatis; pappo 4-squamellato biaristato. — Andes of Peru, between Obrajillo and Culluay.

COREOPSIS (AGARISTA) PICKERINGII (sp. nov.): suffruticosa, fere glaberrima; ramis apice longe nudis monocephalis; foliis oppositis petiolatis triternatisectis, segmentis lineari-subulatis rhachi tenui vix latioribus; involucri squamis exterioribus linearibus interioribus oblongis dimidio brevioribus; paleis receptaculi oblongis obtusissimis, exterioribus dorso villosis; acheniis lineari-oblongis dorso sub palea glabris adventrem et præsertim margines villosissimis biaristatis; aristis villoso-barbellatis corolla paullo achenio dimidio brevioribus. — High Andes of Peru above Obrajillo. — This is one of a group of species of the Andes which unite De Candolle's Californian genus *Agarista* to *Coreopsis*. Of these *C. fasciculata*, Wedd. is in the present collection, and is no. 571 of Matthews's collection in the same district, wherefore I had named it *C. Matthewsii* in the Hookerian herbarium. It has both faces of the achenia glabrous, but the margins ciliate with long villi. *C. venusta*, H. B. K., or an apparent variety of it with nearly filiform leaves and smaller heads on short peduncles, was gathered by Matthews in the province of Chachapoyas. *C. capillacea*, H. B. K., was collected by Seemann at Loxa. And the two succeeding species (of which the latter

most nearly approaches De Candolle's genus *Agarista*) are described from specimens in the Hookerian herbarium.

COREOPSIS (AGARISTA) FOLIOSA (sp. nov.): ramis hirtellis usque ad apicem confertissime foliosis; foliis (subpollicaribus) oppositis glaberrimis rigidis crassiusculis tripartitis, segmentis lateralibus anguste spathulato-oblongis, terminali tripartito; capitulis paucis subcorymbosis breviter pedunculatis; involucri externi squamis 8 lineari-oblongis obtusissimis pubescentibus quam interiores ovales ⅓ brevioribus; ligulis (flavis) oblongis; corollis disci luteis demum brunneis; acheniis oblongis hirsutis utrinque unicarinatis margine hirsutissimis biaristatis; aristis subsquamelliformibus triquetris dense ciliato-hirsutis corollam adæquantibus. — Andes of Peru, Matthews, No. 1376.

COREOPSIS (AGARISTA) SPECTABILIS (sp. nov.): suffruticosa? glabra; foliis oppositis circumscriptione rotundis bipinnatisectis vel 3–5-sectis, segmentis 5-partitis, lobis linearibus acutis integerrimis bi–trifidisve laxis; ramis in pedunculum longissimum (6–10-poll.) nudum monocephalum desinentibus; involucris ambobus 8-phyllis glaberrimis basi connatis, squamis exterioris linearibus quam interiores ovato-oblongæ colorato-marginatæ dimidio brevioribus; ligulis 8 magnis; disco luteo brunnescente; acheniis lineari-oblongis extus sub palea glabris marginibus et costa ventrali longissime villosis aristas 2 paleoliformes villoso-ciliatas corollam subæquantes gerentibus. Folia sesquipoll. diametro, capitulum disco semipoll. et ultra diam.; ligulæ pollicaria, flavæ. — Andes of Peru, McLean.

COREOPSIS MAUIENSIS (sp. nov.): fruticosa, diffusa, parce hirtella, mox glabrata; foliis trisectis, segmentis oblongis vel subcuneatis inciso-dentatis (nunc 3–5-partitis seu terminali pinnatipartito); pedunculis elongatis monocephalis; involucri exterioris phyllis linearibus (apice nunc glandula instructis) interiores æquantibus; acheniis glabris anguste oblongis modice alatis haud contortis apice bidentatis, dentibus triangulari-subulatis. — Maui, Sandwich Islands, on sandy or dry hills near the coast; a form with more dissected leaves also collected by Remy.

Coreopsis and *Bidens* are separated by a single, artificial, and not wholly constant character. The group of species on which Nuttall grounded his genus *Diodonta* wholly accords with the *Platycarpæa* section of *Bidens*, except that the awns or teeth are antrorsely hispid or naked. Recently we have received, from Mr. Fritchey of Missouri, specimens of *C. aristosa*, Michx., or perhaps of a wild cross between

that species and some *Bidens*, with *retrorsely* hispid awns. The Sandwich Islands offer a series of species which equally connect the *Psilocarpæa* section of *Bidens* with *Coreopsis*. Some of these, having their achenia remarkably curved or twisted at maturity, were naturally distinguished as a separate genus, *Campylotheca*. But its adoption merely gives us three limitless genera unmarked by any peculiarity of habit in the place of two artificially separated ones. The foregoing species is in all respects a good *Coreopsis*. The first of the following ones differs merely in its elongated achenium, slightly disposed to curve or twist. The others are *Campylothecæ*, with more or less curved or spirally twisted achenia, either narrowly wing-margined or wingless, but manifest congeners of the rest. Their union with *Coreopsis* is suggested both by their wanting the technical character of *Bidens*, and by the fact that the former already contains species with winged and with curved achenia. On the other hand only a slight and arbitrary line is to be drawn between *Bidens Sandwicensis*, Less., and *Campylotheca micrantha*. Yet when the (always straight) achenia of the former bears awns, these are retrorsely hispid, although sparingly so. Vain is the attempt to draw absolute limits where Nature luxuriates in gradations; but, on the whole, the old distinction between *Bidens* and *Coreopsis* appears to be practically the best one.

COREOPSIS (CAMPYLOTHECA) MACROCARPA (sp. nov.): herbacea? glabra; foliis pinnatim 5-sectis, segmentis ovatis cuspidato-acuminatis argutissime creberrime serrulatis; pedunculis oligocephalis folia subsuperantibus; acheniis pro capitulo magnis (subpollicaribus) linearibus striatis alatis vix tortis subapice biaristulatis seu bicorniculatis. — Sandwich Islands, on the mountains of Oahu.

COREOPSIS (CAMPYLOTHECA) MACRÆI (*Campylotheca grandiflora*, DC. Prodr.): herbacea, puberulo-hirtella; ramis elongatis patentibus; foliis ternatim sectis, segmentis lanceolatis acuminatis creberrime serratis; capitulis laxe paniculatis haud magnis; acheniis linearibus glaberrimis calloso-marginatis calvis "aut junioribus vix bisetosis" spiraliter tortis. — Hawaii, Sandwich Islands, Macrae, Remy. The above character is drawn up (with De Candolle's in view) from no. 287 of Remy's collection, supplied by the Paris Museum. The species does not merit the name *grandiflora* (preoccupied in *Coreopsis*), although the heads are nearly twice the size of those of *C. micrantha*.

COREOPSIS (CAMPYLOTHECA) COSMOIDES (sp. nov.) herbacea, fere glabra; foliis caulinis pinnatim 5-sectis summisve trisectis, ramealibus

sæpe indivisis segmentisque ovato-oblongis acuminatis argute serratis membranaceis; pedunculis breviusculis monocephalis; capitulo magno (pollicem longo); involucro exteriori 8-phyllo interius adæquante, phyllis oblongis seu oblongo-lanceolatis; ligulis (subpollicaribus) apice inciso lobatis; genitalibus præsertim stylo longissimo valde exsertis; acheniis (immaturis) linearibus exalatis nunc flexuoso-curvatis margine hispidulis apice setuloso-coronulatis aristis 2 brevibus seu brevissimis fere nudis subterminatis. — Hawaii, Sandwich Islands: also in coll. Remy, no. 278.

COREOPSIS (CAMPYLOTHECA) MENZIESII (sp. nov. *Campylotheca australis*, Less. pro parte?): suffruticosa, fere glaberrima, corymboso-ramosa; foliis bipinnati-(vel subternati-) sectis, summis 3 – 5-partitis, segmentis longe anguste linearibus integerrimis; capitulis parvis (2 lin. longis) plurimis in corymbum digestis breviter pedunculatis; involucro exteriori breviore; acheniis angustissime linearibus elongatis glaberrimis apice calvis rariusve obsolete 1 – 2-setulosis, exterioribus sæpe tenuiter subalatis, maturis leviter flexuosis vel tortis. — Variat inflorescentia foliisque (segmentis interdum laciniatis) pl. m. pubescentibus. Ligulæ 3 lin. longæ. — Hawaii and Maui, Sandwich Islands. Also collected by Menzies, Chamisso? and Remy.

COREOPSIS (CAMPYLOTHECA) MICRANTHA (*Bidens micrantha*, Gaud. *Campylotheca micrantha*, Cass. *C. australis*, Less. excl. syn. Forst. & Spreng.): basi suffruticosa, glabra, paniculato-ramosa; foliis pinnatim 3 – 7-sectis partitisve, summis nunc indivisis, segmentis lanceolatis seu oblongo-lanceolatis grosse argute serratis nunc incisis nunc 3 – 5-fidis venosis; capitulis parvis (2 lin. longis) plurimis corymbosis; involucris subæquilongis; acheniis elongatis angustissime linearibus glabris exalatis apice nudo aut truncato aut sæpius mucrones vel aristulas 1 – 2 breves læves gerentibus, maturis brunneis arcte spiraliter contortis. — Sandwich Islands, especially Oahu. Variable in the foliage, which is commonly more dissected than in Gaudichaud's figure. Chamisso seems to have had specimens of *C. Menziesii* intermixed with various forms of the present species. The achenium, described by Lessing as "anguste alatum" would appear to belong to the former species.

BIDENS SANDWICENSIS (Less.): herbacea, glabra; foliis membranaceis plerisque trisectis, segmentis ovatis seu ovato-lanceolatis acuminatis argute serratis, lateralibus petiolulatis vel sessilibus; capitulis laxe corymboso-paniculatis parvis radiatis; involucri phyllis linearibus glabris eciliatis; acheniis anguste linearibus glabris vel marginibus parce hispidulis apice setulosis aut exaristatis aut aristulis 1 – 2 (nunc nudis nunc parce retrorsum hispidulis) superatis. — To this belongs *B. micrantha*, Hook. & Arn., but not of Gaudichaud; *B. peduncularis*, DC., but not of Gaudichaud; *B. mutica* and *B. gracilis* of Nuttall. In more than one collection it has been confounded with *Campylotheca micrantha*. Moreover, the awnless state is doubtless the *Adenolepis pulchella* of Lessing; a gland-like thickening at the tip of the involucral scales being often obvious in this, and also in some allied species (especially in *Coreopsis Mauiensis*), but it is inconstant. To this species may also be referred *B. paniculata*, Hook. & Arn., from Tahiti (as a simple-leaved state, with the awns more developed and more barbed than usual), and probably *B. angustifolia*, Nutt. (with dissected leaves); likewise the following varieties: —

Var. HETEROPHYLLA (*B. luxurians*, Hook. & Arn.): caule basi suffruticosa? foliis longe petiolatis plerisque simplicibus oblongo-lanceolatis acumine longo integerrimo caudatis basi attenuatis, paucis trisectis, segmentis sublinearibus; acheniis sæpius biaristulatis.

Var. OVATIFOLIA: caule herbaceo; foliis simplicibus ovatis subcordatis longissime petiolatis; ovariis coronula setularum superatis exaristatis.

BIDENS HAWAIENSIS (sp. nov.): herbacea, glaberrima; caule elato ramoso polycephalo; capitulis corymboso-paniculatis; foliis omnibus simplicibus longe petiolatis oblongis vel ovatis acutis vel acuminatis crebre serratis crassiusculis; involucri glaberrimi phyllis linearibus obtusis eciliatis; ligulis 7 – 8 elongatis; acheniis anguste linearibus glabris apice nudo breviter biaristatis, aristis erectis retrorsum barbatis. — Hawaii, Sandwich Islands, at various stations. Disk of the capitulum when in flower 3 or 4, in fruit fully 6, lines long; ligules yellow, 5 – 9 lines long.

BIDENS LANTANOIDES (sp. nov.): fruticosa, ramosa, hirsutulo-pubescens; foliis omnibus simplicibus ovalibus oblongisve creberrime serratis petiolatis; pedunculis solitariis monocephalis folia subæquantibus; involucri exterioris phyllis lineari-oblongis discum adæquantibus; ligulis brevibus; acheniis lineari-subtetragonis marginibus apiceque hispidulis breviter vel brevissime biaristatis. — Eimeo, Society Islands. Head 4 lines in diameter.

Var.? GLABRATA: magis herbacea; foliis utrinque attenuatis; capitulis subpaniculatis. — Tahiti.

LIPOCHÆTA, DC. excl. sp. Amer.

Lipotriche, pro parte, Less. in Linnæa, 6, p. 510, & Syn. p. 231, non R. Br.
Lipochæta, DC. Prodr. 5, p. 610, excl. sp. Amer. (i. e. sp. *Zexmeniæ*).
Microchæta, Nutt. in Trans. Amer. Phil. Soc. 7, p. 450, excl. sp. *Wollastoniæ*.
Schizophyllum, Nutt. l. c. p. 452, non Fries.
Aphanopappus, Endl. Gen. Suppl. 2, p. 43.
Macræa, Hook. f. in Proceed. Linn. Soc. n. 28, p. 278, & Linn. Trans. (Fl. Galap.).
Trigonopterum, Anderss. Veg. Galap. in Voy. Eugen. Bot. t. 6, f. 1.

I cannot doubt that the following Sandwichian species are all congeneric, notwithstanding their diversified habit, and the complete abortion in two of them of the short awns or chaffy scales of the pappus. With the latter may also be associated Dr. Hooker's *Macræa*, in which the coronula is generally a little more developed, and the awns obsolete, but not always entirely wanting. To merge all these plants in *Wollastonia* (which shows no tendency to winged achenia) would hardly be permitted, although the earlier-enumerated of the following species would not there appear widely out of place. On the whole, it will be more difficult to separate them clearly from *Wedelia* on the one hand and *Zexmenia* on the other.

Since the last-named genus takes in all the American species of De Candolle's *Lipochæta*, which genus was essentially founded upon Lessing's *Lipotriche*, and this mainly upon the leading Sandwichian species, it is evident that the present group should in strictness bear the name of *Lipochæta*. If the rule of priority be waived on account of the inappropriateness of this name to one or two of the species, the succession would best fall upon *Macræa*. But convenience in the present instance coincides with precedence.

L. AUSTRALIS (*Lipotriche australis*, Less.): suffruticosa, hirtello-scabra vel hispidula; foliis ovatis ovato-lanceolatisve 3–5-plinerviis acuminatis argute serratis nunc incisis aut sessilibus aut in petiolum brevem marginatum decurrentibus; involucri squamis ovato-lanceolatis subacuminatis.

Var. *α*. CONNATA (*Verbesina connata*, Gaud. *Lipochæta connata*, DC.): foliis sessilibus basi nunc angustata connatis nunc late connato-amplexicaulibus.

Var. *β*. DECURRENS: foliis basi in petiolum plerumque alatum contractis, lamina nunc ovata seu rhombea nunc oblongo-lanceolata, in latifoliis sæpius argute duplicato- vel laciniato-serrata. — Here probably belongs *Microchæta lanceolata*, Nutt.

Var. γ. LOBATA (*Verbesina lobata*, Gaud. *V. hastulata*, Hook. & Arn. *Lipochæta lobata & hastulata*, DC.): foliis subsessilibus vel breviter petiolatis basim versus utrinque lobatis seu laciniato-dentatis. — Pappus, in all the forms of this polymorphous species, of 2 or 3 short chaffy awns or narrow scales. In all the species an epigynous gland, at the base of style of the disk-flowers, fills the bottom of the tube of the corolla.

L. SUBCORDATA (sp. nov.): herbacea? erecta, cinereo-strigulosa; foliis deltoideo-subcordatis acuminatis duplicato-serratis reticulatis longe petiolatis, petiolis gracilibus; involucri squamis ovato-oblongis obtusiusculis. — Hawaii, on the coast.

L. CALYCOSA (sp. nov.): fruticosa, hispidulo-scabra; foliis lanceolatis oblongisve obtusis obsolete subserratis vix triplinerviis brevissime petiolatis; involucri squamis 5–8 ovalibus seu obovatis obtusissimis foliaceis discum subsuperantibus; paleis receptaculi convolutis truncatis. — Diamond Hill, Oahu.

L. LAVARUM, DC. (*Verbesina lavarum*, Gaud.) Well marked by its silvery-canescent (but scarcely strigose) leaves, which vary from narrowly to broadly lanceolate or oblong, the veins and triple ribs conspicuous beneath. Achenia all fertile, very variable (as in the other species and in the manner of many Verbesinoid genera) as to the wings, &c. The wings, when developed, are extended upwards into a salient process as long as the pappus (which is of 2 or 3 stout, puberulent, more or less clavate and blunt awns or paleæ) but wholly free from it.

L. INTEGRIFOLIA (*Microchæta integrifolia*, Nutt.): herbacea e radice lignescente, humifusa, ramosissima, minutim sericeo-canescente; foliis subcarnosis parvis (pollicaribus) spathulatis linearibusque integerrimis, venis haud perspicuis; pedunculis solitariis terminalibus; involucri squamis biseriatis ovatis vel rotundis obtusissimis disco brevioribus; paleis receptaculi obtusissimis. — Oahu and Maui. Achenia generally less winged than in the preceding.

L. SUCCULENTA, DC. (which Remy has collected both upon Nihau and Kauai), has the habit of *Eclipta*, and ranges between *L. australis* and *L. integrifolia*. The leaves are not absolutely glabrous; a lens shows some minute strigose hairs.

L. HETROPHYLLA (sp. nov.): suffruticosa, ramosissima, erecta, aspero-hispidula; foliis plerisque trifidis, segmentis oblongo-linearibus seu lineari-lanceolatis denticulatis nunc laciniatis vel inciso-pinnatifidis; involu-

cri squamis late ovatis sæpius acuminatis disco parum brevioribus; paleis receptaculi mucronatis. — Folia 1–3-pollicaria, nunc petiolata petiolis marginatis, nunc connato-amplexicaulia. — Maui. Pappus of 2 or 3 very short and squamellate awns or paleæ, which are somewhat coroniform concreted at their base.

L. TENUIFOLIA (sp. nov.): herbacea, erecta, gracilis, fere glabra: foliis pinnatipartitis, segmentis rhachique angustissime linearibus seu filiformibus integerrimis; involucri squamis lanceolatis discum adæquantibus; paleis receptaculi acutatis. — Oahu. The achenia are 2–4-angled, their angles sometimes slightly winged, or produced at the summit; and the pappus consists of 2 to 4 short and somewhat deciduous awns.

L. (APHANOPAPPUS) MICRANTHA (*Schizophyllum micranthum*, Nutt. *Aphanopappus Nuttallii*, Walp.): herbacea, minutim strigulosa; caulibus gracillimis ramosissimis diffusis; foliis tenuibus bi–tripinnatipartitis, segmentis parvis subcuneatis sæpe bi–trilobatis; capitulis parvis breve pedunculatis; involucri squamis exterioribus lineari-spathulatis laxis, interioribus oblongis; ligulis 2–3 ovalibus; fl. disci 6–8; acheniis apteris; pappo obsolescente. — Kauai (Atooi). Ovaries pubescent at the summit, as in *Lipochæta* generally, the short hairs, or part of them, apparently forming a minute coronulate pappus, of which only mere vestiges remain upon the mature short-obovate achenium. The exterior achenia are the most fertile, and turgid, 3–4-angled; the inner more compressed or lenticular; the central ones by no means always infertile.

L. (APHANOPAPPUS) REMYI (sp. nov.): herbacea, ramosissima, diffusa, cinereo-hirsuta; foliis oblongis petiolatis obtusis sæpius parce dentatis vel sublobatis, superioribus alternis; capitulis parvis subpaniculatis breviter pedunculatis; involucri squamis oblongis obtusis; ligulis 5–7 obovatis brevibus; acheniis radii præsertim ad angulos tuberculatis vel interrupte subalatis, disci inanibus; pappo obsoleto. — Oahu, Remy, no. 260.

L. (APHANOPAPPUS) LARICIFOLIA. *Macræa laricifolia*, Hook. f. *Trigonopterum Ponteni*, Anders. — Galapagos Islands.

GUNTHERIA MEGAPOTAMICA, Spreng. *Polypteris Brasiliensis*, Less. in Linnæa. *Cercostylis Brasiliensis*, Less. Syn. Compos. Sprengel's name for the genus, founded like Lessing's upon Sellow's specimens, and revived by Schlechtendal (Linnæa, 11, p. 4), is the earlier by several years, and nothing stands in the way of its restoration. The genus is the representative, on the plains of Buenos Ayres, &c., of *Gaillardia* and *Agassizia* in the equivalent region of North America; and the three genera are very closely related. The style of the *Guntheria* is intermediate between that of these two related genera, from both of which it recedes in the want of rays, and of an involucellate coma around the achenia.

Var. SCABIOSOIDES: foliis pinnati- vel sub-bipinnati-partitis. *C. scabiosoides*, Arn. in DC.

RAILLARDIA, Gaud. — Although the rays of the pappus are setæ instead of paleæ, the true place of this genus is next to *Dubautia*, among the *Helenieæ*. It differs from *Dubautia* chiefly in the slender and truly plumose setæ of the papus, the absence of chaff to the receptacle (which is convex or obtusely conical and pubescent) and in the nearly valvately uniserial involucre, the scales of which connive or lightly cohere into a cylindrical cup. These two genera, with *Argyroxiphium* and *Wilkesia* (a connecting link between *Argyroxiphium* and *Dubautia*) are the striking, characteristic, and wholly peculiar shrubby or arborescent Compositæ of the Sandwich Islands, especially of their high mountain region or elevated lava plains. The present collection contains specimens of the four published species of *Raillardia*, in such perfection and variety as to enable me to characterize them properly, and also five others. Some of these are so polymorphous — after the fashion of the characteristic plants of those Islands — that, at the first view of the collection, one would be disposed to double the number of species here admitted. The species now known may be arranged as follows, under three sections; of which the third, by its nervose leaves and more numerous flowers in the capitula, most approaches the genus *Dubautia*.

§ 1. *Venoso-reticulatæ.*

1. RAILLARDIA LATIFOLIA (sp. nov.): foliis oppositis planis amplis oblongis penninerviis reticulato-venulosis dissitis subpetiolatis cum ramis elongatis patentibus glaberrimis; capitulis 4–5-floris numerosissimis in panicula nuda composita effusa. — Island of Kauai. A rambling shrub.

§ 2. *Uninerviæ, aveniæ.*

2. RAILLARDIA SCABRA (DC.): humilis; caulibus floridis (½–2-ped.) gracilibus superne parce foliatis fere herbaceis e basi decumbente fruticosa ramosa; foliis plerisque alternis linearibus uninerviis supra vel

undique hispidulo-scabris marginibus revolutis haud raro parce dentatis, inferioribus confertissimis reflexis; capitulis plurimis paniculato-corymbosis 5–7-floris. — Var. β. HISPIDULA: gracilior, foliis anguste linearibus utrinque hispidulis. γ. LEIOPHYLLA: foliis anguste linearibus lævigatis vel superne obsolete marginibusque hispidulo-scabris. — Hawaii and Maui.

3. **RAILLARDIA LAXIFLORA** (DC.): ramis etiam floridis ligneis sæpius foliosissimis; foliis latiuscule linearibus seu lanceolatis planis vel marginibus (scabris nunc denticulatis) parum revolutis uninerviis crassis supra lucidis scaberulis seu lævigatis patentibus serius reflexis, plerisque ternato-verticillatis, superioribus sæpe alternis; panicula subsimplici laxa; capitulis plerumque longe pedicellatis 6–13-floris. — Hawaii. Intermediate between the preceding and the following, apparently very different, species.

4. **RAILLARDIA CILIOLATA** (DC.): ramosissima; ramis usque ad apicem confertissime foliosis ligneis; foliis lanceolatis lineari-oblongis vel obtuse lanceolato-subulatis crassis uninerviis infra convexis seu carinatis supra concavis vel marginibus (semper hispidulo-ciliatis scabrociliolatisve) leviter involutis lucidis oppositis ternisve plerisque arrectis seu erectiusculis et secus ramos steriles imbricatis; capitulis paucis subracemosis 5–12-floris. — Variat foliis vernicoso-lucidis vel opacis, lævigatis scaberulis vel hispidulis, et (in extremis), β. LAXIFOLIA: foliis patentibus subplanis minus crebris. γ. JUNIPEROIDES: foliis minoribus involuto-canaliculatis quasi acerosis confertissimis imbricatis; capitulis subsolitariis. — Hawaii.

§ 3. *Nervosæ.*

* Folia plana, 3–11-nervia, omnia opposita vel plerumque terna, subpatentia vel patentissima, nunc denticulata.

5. **RAILLARDIA LINEARIS** (Gaud.): orgyalis; ramis laxis patentibus; foliis confertiusculis lanceolatis linearibusve 3–5-nerviis utrinque vel basi attenuatis glabris vel sericeo-puberulis; paniculis compositis polycephalis nudis; capitulis cymuloso-fasciculatis 3–7- (raro 12-) floris. — Oahu, Hawaii, and Maui.

6. **RAILLARDIA MENZIESII** (sp. nov.): ramis rigidis usque ad apicem conferte foliosissimis; foliis ellipticis seu lanceolato-oblongis arcte sessilibus 3–5-nerviis scabro-hirsutulis (nunc lævigatis); panicula subsimplici; capitulis pedicellatis 7–15-floris. — Variat foliis laxiusculis subpatentibus seu confertis fere imbricatis, oblongo-lanceolatis seu

ovato-ellipticis, opacis hirsutulis vel nitidis glabratis, marginibus hispidulo-ciliatis. — Hawaii and Maui.

7. **Raillardia platyphylla** (sp. nov.): fruticosa; ramis validis conferte foliosissimis; foliis oppositis lanceolato-ovatis e basi semiamplexicauli ad apicem sensim angustatis subacutis 7 – 11-nerviis undique scaberrimis, junioribus glanduloso-viscosis; panicula nuda; capitulis 10 – 20-floris. — Variat foliis angustioribus oblongo-lanceolatis ternis. — Maui. Leaves 2 or 3 inches long, commonly an inch wide next the base.

8. **Raillardia arborea** (sp. nov.): trunco 20-pedali; ramis validis conferte foliosis; foliis elliptico- seu elongato-oblongis utrinque obtusissimis arcte sessilibus 3 – 5-nerviis glanduloso-scabridis, junioribus viscoso-pubescentibus; panicula basi foliosa cum involucro 9 – 14-phyllo 25 – 45-floro hirsutis et glanduloso-viscosis. — Hawaii, on Mouna Kea. Leaves 1½ to 2 inches long.

* * Folia pl. m. concava, erecto-imbricata, terna, leviter vel infra obsolete 3 – 5-nervia.

9. **Raillardia struthioloides** (sp. nov.): caule arborescente; foliis secus ramos imbricato-confertis oblongo- seu elliptico-lanceolatis acutiusculis arcte sessilibus cinereo-hispidulis vel scabridis, junioribus hirsuto-ciliatis; panicula seu racemo simplici; involucro 6 – 9-phyllo 12 – 20-floro. — Hawaii, on Mouna Kea, with the preceding and higher. Leaves 1½ to 2 inches long.

DUBAUTIA, Gaud. — The best published description is that of Lessing, who rightly ascribed to *D. plantaginea* a couple of paleæ on the receptacle. These, overlooked by Hooker and Arnott, and therefore, it would seem, ignored by De Candolle and Endlicher, are generally if not always present whenever the flowers are more numerous than the scales of the involucre, subtending the flowers which are not subtended, and their achenia embraced, by the involucral scales. In *D. laxa*, accordingly, these paleæ are more obvious, and still more striking are they in a new species with many-flowered heads, which is moreover remarkable for its truly paleaceous, instead of aristiform, pappus. As the old species need diagnoses as well as the new, I append the characters of all of them.

1. **Dubautia plantaginea** (Gaud.): foliis glabratis glabrisve elongato-lanceolatis sensim acuminatis basi modice angustatis; capitulis parvis 7 – 10-floris numerosissimis in ramos divergentes folioso-bracte-

atos paniculæ thyrsoideæ magnæ congestis; receptaculi parvi paleis 1–3; corollæ tubo gracili limbo abrupte campanulato duplo longiore pappi sordidi paleas aristiformes barbellatas subsuperante. — Oahu and Hawaii. — In Gaudichaud's original specimens the inflorescence is undeveloped, so that his plate gives no idea of the ample, thyrsoid, compound panicle, the divaricate primary branches of which are sometimes six inches long, nor of the great number of the small heads. The leaves, also, are represented as much too broad at the base.

2. DUBAUTIA LÆVIGATA (sp. nov.): foliis oblongo-lanceolatis deorsum longe attenuatis quasi petiolatis ultra medium argute serratis laxe inconspicue plurinerviis nitidis ramisque glaberrimis; panicula thyrsiformi pedunculata nuda; receptaculo parvo. Flores desunt. — Kauai, Sandwich Islands. Incompletely known; possibly a variety of the foregoing.

3. DUBAUTIA LAXA (Hook. & Arn.): foliis glabratis vel strigoso-hispidis oblongo-lanceolatis rariusve ovali- seu cuneato-oblongis antice argute serrulatis acuminatis deorsum longe attenuatis; capitulis 10–15-floris parvulis in cymam brevem congestis; corolla paleas pappi (mox rufi) subulato-aristiformes serrato-fimbriolatas vix superante, tubo glanduloso. — Oahu. Badly named, the inflorescence being less lax than that of *D. plantaginea* in fully developed specimens.

4. DUBAUTIA PALEATA (sp. nov.): foliis strigoso-hispidulis lato lanceolatis utrinque vix angustatis sessilibus; capitulis 12–30-floris corymbosis paucis majusculis (5–6 lin. longis); receptaculo elevato paleis pluribus onusto; corollæ tubo pappi paleas lanceolatas margine eroso-denticulatas superante, fauce vix ampliata, limbo 5-partito. — Kauai, Sandwich Islands.

ARGYROXIPHIUM and WILKESIA. The characters of the latter genus, and of a new species of *Argyroxiphium*, with the announcement that this had a circle of paleæ at the margin of the receptacle, — and epappose ray-achenia enclosed in the involute subtending scales of the involucre, and therefore belonged to the *Madieæ*, — were published by me, in the Proceedings of the Academy (Vol. II. p. 160), a dozen years ago. These notes appear to have escaped attention. Having now further to add that the paleæ of *Argyroxiphium* are concreted into a cup, in the manner of several *Madieæ*, — so that, indeed, *Wilkesia* may be viewed as an *Argyroxiphium* with the ray-flowers and the subtending involucre suppressed, — it is worth while to reproduce the characters with emendations.

WILKESIA, Gray.

Capitulum homoganum, multiflorum. Involucrum campanulatum, 14 – 28-dentatum, hinc inde subincisum, herbaceo-membranaceum, dentibus villoso-ciliatis. Receptaculum convexum, nudum, glabrum. Flores hermaphroditi, conformes. Corollæ tubulosæ, glabræ, e tubo gracili cyathiformes, lobis 5 brevibus recurvis. Antheræ ecaudatæ. Styli rami revoluti, cono hispidulo complanato apice subulato superati. Achenia elongata, compresso-quadrangulata, ad angulos seu costas hispidula. Pappus paleaceus, persistens, uniserialis, paleis 8 lanceolato-subulatis hirto-ciliatis. — Arbuscula? Sandwicensis, Yuccæformis; caule simplici orgyali seu biorgyali; foliis lineari-gladiatis summisve lanceolatis coriaceis crebre nervulosis præter margines tomentoso-ciliatos glabris (nascentibus sericeis) in verticillos propinquos polyphyllos congestis et per baseos pl. m. coadunatis; pedunculis gracilibus glandulosis 1 – 5-cephalis ex axillis fol. supr. ortis paniculam laxam amplam efficientibus; capitulis post anthesin nutantibus.

Wilkesia gymnoxiphium, Gray, l. c. — Kauai, Sandwich Islands, alt. 3,700 feet.

ARGYROXIPHIUM, DC.

Capitulum hemisphæricum, heterogamum, multiflorum; fl. radii uniserialibus ligulatis fœmineis, disci hermaphroditis tubulosis. Involucrum uniseriale, squamis numerosis (tot quot ligulæ) discum subæquantibus angustis convolutis achenia radii involventibus. Receptaculum convexum vel conicum, inter radium et discum gerens paleas uniseriales gamophyllas, ceterum nudum. Ligulæ breves, plerumque tridentatæ. Corollæ fl. herm. glabræ, e tubo gracili sursum ampliatæ, 5-dentatæ. Antheræ ecaudatæ; filamenta sub apice articulata. Styli rami lineares, fl. herm. cono complanato hispidulo superati. Achenia elongata, glabra, 4 – 5-angulata angulis costæformibus, radii incurva, aut omnia præter coronulam brevem calva, aut disci pappo persistente, e paleis paucis valde inæqualibus subconcretis, superata. — Herbæ? insignes, Sandwicenses, 3 – 6-pedales; caule simplici percrasso foliis angustis pugioniformibus plerumque sericeo-argenteis confertissimis undique horrente, panicula ampla laxius foliata terminato; pedunculis viscoso-pubescentibus; capitulis nutantibus; floribus radii luteis, disci roseo-purpureis.

1. A. Sandwicense, DC.: ligulis 12 – 16 longiusculis; styli fl. disci ramis breviter obtuseque appendiculatis; acheniis disci inæqualiter

paleaceo-papposis; receptaculo convexo. — Hawaii, alt. 6,300 – 12,000 feet.

2. A. MACROCEPHALUM (Gray in Proceed. Amer. Acad. 2, p. 160): capitulo sesqui – bipollicari; ligulis 20 – 30 brevibus; styli fl. disci ramis cono acuto superatis; pappo nisi coronula brevissima disciformi nullo; receptaculo conico. — Maui, above 9,000 feet.

ABROTANELLA (CERATELLA) SUBMARGINATA (sp. nov.): pulvinato-cæspitosa; foliis crebris linearibus e basi erecta patentibus sursum leviter calloso-marginatis truncato-obtusis vel retusis; capitulis solitariis subsessilibus paucifloris; involucri squamis subuninerviis; acheniis obsolete 3 – 4-nervatis angulatisve inferne hirtellis pappo coroniformi et pauci-aristulato vel dentato superatis. — Orange Harbor, Fuegia. — In foliage nearly intermediate between *A. emarginata* and the following species, in general appearance very like *A.* (*Ceratella*, Hook. f.) *rosulata*, but the leaves smaller and narrower. Heads and flowers nearly as in *A. emarginata*, but with a rather conspicuous pappus, consisting of a thin and scarious coronula, two to four teeth of which are commonly extended into short awns. — Nothing is less reliable, at least generically, than distinctions founded upon the presence, degree of development, or absence of a paleaceous, coroniform, or other reduced kind of pappus. Dr. Hooker will not be surprised that this and the following species demand the reduction of his *Ceratella*, *Trineuron*, and therefore *Scleroleima*, to *Abrotanella*.

ABROTANELLA (CERATELLA) LINEARIFOLIA (sp. nov.): laxe cæspitosa; foliis linearibus seu lineari-subspathulatis immarginatis patulis, supremis capitulum pedunculatum adæquantibus; involucri squamis ovalibus sub-2 – 3-nervatis; floribus fœmineis 2 – 3, hermaphroditis 6 – 8 stylo pl. m. bifido, omnibus sæpissime fertilibus; acheniis glaberrimis elongato-obovatis 4-costatis apice subcontractis pappo obscure cupulato truncato nunc sub-4-dentato nunc plane 4-aristulato superatis. — Orange Harbor, Fuegia. — With the aspect and foliage (although on a rather smaller scale) of *A. spathulata* (*Trineuron*, Hook. f.) this has the floral characters of *A.* (*Ceratella*) *rosulata*, except that the flowers are all fertile; and as to the pappus, it is intermediate between *Ceratella* and *Scleroleima*.

ARTEMISIA AUSTRALIS, Less. Frutex!

Var. *a.* ESCHSCHOLTZIANA: foliis adultis subtus canescentibus supra glabratis, lobis planis sæpius parce incisis. — Oahu and Kauai.

Var. β. Mauiensis : foliis utrinque incanis, vetustissimis glabrescentibus, divisionibus lobisque plerumque filiformibus integerrimis. — Crater of Maui.

Lucilia, Cass., remanded to the *Gnaphalieæ* by Remy, and rightly described as to the pappus by Weddell, ought to include *Belloa*, too slightly distinguished by the papillose instead of silky achenia, as is *Merope*, by the at length spreading, instead of connivent, scales of the involucre. In some specimens they appear neither to spread nor to connive. — Nuttall's *Gnaphalium depressum*, described from Pichincha specimens of Professor Jameson's collection (no. 642 and 57) is not the *G. radians*, Benth. i. e. *L.* (*Merope*) *Kunthiana*, but apparently the *L. conoidea*, Wedd., or near it, although larger. *L. gnaphalioides*, Less. includes *L. argentea*, Hook. & Arn., in which, by a typographical error of the Prodromus, the heads are said to be three-flowered in place of thirty-flowered.

Lucilia (Merope) piptolepis, Wedd., a form with more caulescent sterile shoots from the Peruvian Andes.

Lucilia (Merope) Schultzii (*Gnaphalium evacoides*, Schultz Bip. and *Merope Schultzii*, Wedd.), a depressed, pulvinate plant, with the habit of *Silene acaulis*, has glabrous achenia.

Lucilia (Merope) Pickeringii (sp. nov.): cano-tomentosa, multiceps, depressa; caulibus confertis uncialibus foliatis; foliis spathulatis seu obovatis planis dense undique lanuginosis; capitulis subsolitariis sessilibus cylindraceis; involucri squamis interioribus linearibus obtusiusculis badiis discum æquantibus; acheniis minutim papillosis. — Var. β.? minor: condensata, pube appressa, capitulis minoribus aggregatis. — High Andes of Peru.

ANTENNARIA § MNIODES. — Plantæ andicolæ, musciformes, densissime pulvinato-cæspitosæ, cinereo-tomentosæ; foliis obovatis squamæformibus creberrimis arcte imbricatis; capitulis solitariis in apice ramulorum inter folia sessilibus fere absconditis: dioica.

1. Antennaria (Mniodes) andina (sp. nov.): foliis lingulato-subcuneatis fere truncatis retusisve utrinque pilis longis crebris villoso-crinitis; involucri squamis lineribus obtusis; acheniis glabris; pappi setis fl. masc. apice subito valde clavato-incrassatis. — Alpamarca, high Andes of Peru. Also collected by Hænke, in the same region. Forming cushion-like perennial tufts, like those of *Leucobryum*, and of the related *Maja*, Wedd. Flowers as in *Antennaria*.

2. **ANTENNARIA (MNIODES) ARETIOIDES** (*Baccharis aretiodes*, Schultz Bip., *Merope aretioides*, Wedd. Chlor. And. t. 25), from the Andes a little farther south, has more obovate, less truncate, and much less villous leaves, papillose sterile ovaria (fertile plant not known), and the bristles of the male pappus very gradually and moderately thickened upwards. These distinctions are derived from Weddell's figure and description, and from a small specimen of no. 1823 of Lechler's collection, kindly communicated by Dr. Schultz. But what he has communicated under the same name, from Hænke's *reliquiæ*, is plainly the *A. andina*.

WERNERIA, H. B. K. This interesting and now rather polymorphous andine genus, like its analogue *Senecio*, is either radiate or discoid, the rays either yellow, white, or rose-color; the branches of the style are either truncate, or, in a few species, tipped with a setiform appendage. In one remarkable species the receptacle is alveolate; in one or two the leaves on the branches, or some of them, are opposite; in several there are five abnormal nerves to the disk-corollas, occupying the axis of the lobes, as in De Candolle's *Mesogramma;* but this is an inconstant character. The collection of the Exploring Expedition comprises the following species, viz.: —

WERNERIA NUBIGENA, H. B. K., including, with Weddell, *W. disticha* and *graminifolia*, but not *W. rigida* (misprinted *frigida* by De Candolle), which is apparently the larger form of *W. pumila.*

WERNERIA ORBIGNYANA, Wedd., var. **BREVIRADIATA**: involucri laciniis 10–14 ligulas breves adæquantibus; foliis sæpius integerrimis. — High Andes of Peru, near Casa Cancha. This, which I had formerly named *W. nuda*, is perhaps *W. nubigena* var. *caulescens, leioscapa*, Wedd. l. c.

WERNERIA VILLOSA (sp. nov.): rhizomate repente; caule florifero gracili simplici usque ad capitulum parce folioso villoso-lanato; foliis angustissime linearibus primum villosis mox glabratis, summis brevibus filiformibus capitulum bracteantibus seu involucrantibus, radicalibus obtusis deorsum longe attenuatis, basi dilatata scariosa intus fulvo-crinita; involucro 12–15-fido, lobis lineari-lanceolatis margine scariosis; ligulis exsertis; styli ramis apice truncato penicillato-hispidis; achenio glabro. — High Andes of Peru near Alpamarca. — To be compared with *W. staticæfolia*, Wedd., especially the var. *celmisioides;* but that is said to have the branches of the style subulate, &c.

WERNERIA PYGMÆA, Gillies, including *W. Rhizoma*, Remy, *W. mi-*

nima, Walp., *W. graminifolia*, Benth., *W. brachypappa*, *cherlerioides*, and *apiculata*, Schultz Bip. Andes of Chili and of Peru.

WERNERIA CÆSPITOSA, Wedd., which was long ago collected by Dombey, on the high Andes of Peru.

WERNERIA CARNULOSA (sp. nov.): acaulis, cæspitosa, parva (pollicaris), undique glabra; rhizomate crasso fere lignoso ramoso; foliis confertissimis linearibus vel spathulatis brevibus integerrimis obtusissimis carnosis capitulum sessile vix æquantibus; involucro 12-lobo, lobis tubo parum brevioribus lineari-oblongis obtusis apice ciliolatis; ligulis nullis; acheniis glabris; antheris luteis. — High Andes of Peru.

WERNERIA STRIGOSISSMA (sp. nov.): cæspitosa, subpollicaris; rhizomate ramoso crasso repente; foliis rosulatis brevibus spathulatis integerrimis capitulum sessile fulcrantibus cum involucro 10 – 14-fido strigosissimis; vaginis crinitis; ligulis exsertis; styli ramis apice truncato hispidulo penicillatis et appendice setacea auctis; achenio pubescente; pappo rigidulo. — High Andes of Peru near Casa Cancha. Bristles of the leaves themselves denticulate, or the larger ones resolved above into a tuft of slender hairs.

WERNERIA CILIOLATA (sp. nov.): cæspitosa, ramosissima, depressa, glaberrima; ramis brevibus confertissime foliosis; foliis (sæpe oppositis) linearibus subcomplicatis vel canaliculatis acutiusculis subcarnosis sub lente spinuloso-ciliolatis; capitulis sessilibus; involucro cylindraceo pluricostato 8-fido, lobis triangulato-lanceolatis obtusis subscariosis, costa valida; ligulis paucis brevibus; styli ramis truncatis apiculo brevi vel obsoleto; acheniis glabris. — High Andes of Peru, near Alpamarca.

WERNERIA DIGITATA, Wedd. A scanty specimen was collected along with the preceding and the succeeding species, exhibiting some minor discrepancies from Weddell's description. The leaves bear some woolly hairs; their lobes are incrassated, although far less so than in the following, and are blunt, instead of acute; a few of them are truly opposite. Involucre costate or nerved; the divisions 13 to 20, scarcely if at all longer than the tube. The branches of the style, as well in the ray as in the disk, sometimes bear a conspicuous, slender, setiform appendage (either naked or sparingly setulose); sometimes this is obsolete, or not distinguishable from the coarse hairs of the truncate obtuse summit.

WERNERIA DACTYLOPHYLLA, Schultz Bip. This extraordinary species was first detected by Dombey. On account of the habit, the

appendage of the style, and the alveolate receptacle, I was disposed to regard this (as was Dr. Schultz) as the type of a new genus, sustaining to *Gynoxys* the relation which *Werneria* does to *Senecio*. But all these characters break down; that of the style is inconstant even in the same species; the closely allied preceding species has a naked receptacle; and in this the alveoli vary, being sometimes very deep and here and there irregularly extended into scarious fimbrillæ, some of them even half the length of the flowers; while in Dombey's own specimens, in the Parisian herbarium, the receptacle is only moderately alveolate.

SENECIO LEUCOMALLUS (sp. nov.): fruticosus, ramosus, undique albo-lanosissimus; ramis 1 – 3-cephalis ad apicem usque foliosis; foliis spathulatis integerrimis obtusis planis (denudatis glabratis aveniis); capitulis breviter pedunculatis; involucro lanosissimo, bracteolis lineari-subulatis squamas proprias subæquantibus; ligulis nullis; acheniis glaberrimis. — Var. *β.* INCISUS: caulibus laxis adscendentibus; foliis plerisque apice 3 – 5-lobatis vel inciso-dentatis. — Orange Harbor, Fuegia. Related to *S. Patagonicus*, Hook. & Arn., of which *S. Andersonii*, Hook. f. and *S. Duyausii*, Hombr. & Jacquinot are forms.

SENECIO WEBSTERI, Hook. f., var. SUBDISCOIDEUS: ramis adscendentibus; foliis flabellatis grosse crenato-dentatis, basi nunc truncata nunc late cuneata; ligulis paucis parvis tubo brevioribus. — Orange Harbor, Fuegia.

SENECIO DARWINII, Hook. & Arn., var. ERADIATUS: pumilus, condensatus; foliis parvis; ligulis nullis. *S. Lasseguei*, Homb. & Jacquinot? With the preceding.

SENECIO EIGHTSII, Hook. & Arn., in its more luxuriant states shows indications of being only another variety of *S. Darwinii*.

SENECIO TRIFURCATUS, Less., is stoloniferous, a character not mentioned in any published description; but a young stolon is delineated on one specimen in Dr. Hooker's excellent figure.

SENECIO SUBCANDIDUS (sp. nov.): herbaceus vel basi frutescens, laxe arenoso-lanatus; caule mox glabrato erecto sesquipedali apice corymboso; foliis membranaceis, caulinis oblongis ovato-subcordatis vel subdeltoideis grosse duplicato-dentatis crenatisve supra glabratis subtus tomentoso-incanis, petiolo sæpius alato; capitulis in corymbo 3 – 9 longe pedicellatis; involucro circiter 20-phyllo glabrescente (squamis linearibus) basi bracteolis brevibus subulatis parce calyculato; ligulis elongatis; acheniis sericeo-puberulis. — Ludit foliis sinuatis et, var. MINOR: caule subaphyllo oligocephalo; foliis lyrato-pinnatifidis seu pinnatipar-

titis, petiolo basi sæpius stipulato-appendiculatis. — Andes of Peru near Obrajillo. Also crest of Purruchucha, by Matthews, and in some part of Peru by Pavon.

SENECIO GRACILIPES (sp. nov.): herbaceus, pruinoso-pubens; caule erecto simplici pedali parce foliato oligocephalo; foliis membranaceis, inferioribus longissime graciliter petiolatis ovatis subrotundisve sinuato-5–7-lobatis lobis denticulatis, superioribus parvis paucis pinnatifidis petiolo basi aurito-dilatatis; capitulis longiuscule pedunculatis discoideis; involucro parce bracteolis setaceis calyculato 20-phyllo, squamis lineari-lanceolatis dorso hirtellis; acheniis minutim hirtellis. — Andes of Peru, near Obrajillo.

SENECIO RICHII (sp. nov.): herbaceus, glaber; caule erecto gracili apice corymboso polycephalo; foliis angustissime linearibus plerumque laciniatis vel pinnatipartitis; capitulis parvis discoideis pedicellatis; involucro parce minutimque bracteolato 12–13-phyllo, squamis lanceolatis obtusiusculis; acheniis hirtellis. — Var. *β.?* foliis latioribus, lobis lanceolatis; ramis floridis patentibus. — With the preceding.

SENECIO PICKERINGII (sp. nov.): fruticosus, humilis, ramosissimus, glaber; ramulis brevibus rigidis, floriferis capitula 1–3 sub-pedicellata sæpius nutantia gerentibus; foliis crebris linearibus seu lineari-oblongis sessilibus subcarnosis grosse pinnatifido-dentatis rariusve integris; bracteolis calyculi ovatis seu obovatis squamis involucri 10–12 late oblongis triente brevioribus; ligulis nullis; acheniis glabris; pappi setis barbellulatis. — Var. *β.?* foliis minus carnosis magis incisis; capitulis minoribus; bracteolis squamisque involucri angustioribus. — High Andes of Peru, between Culluay and Casa Cancha, &c.

SENECIO DANÄI (sp. nov.): suffruticulosus, cæspitoso-depressus, glabratus; foliis crebris carnosulis linearibus inciso-3–5-dentatis subpinnatifidis vel integerrimis primum cum caule apice subaphyllo monocephalo lanulosis; capitulo nutante discoideo; involucri squamis 14–16 lato-linearibus obtusis cum bracteolis calyculi dimidio brevioris dorso nigro-pubescentibus; acheniis cinereo-puberulis. — Alpamarca, high Andes of Peru.

SENECIO DICLINUS, Wedd. This collection contains male as well as female specimens, as also does the Hookerian herbarium, in specimens collected by Mr. McLean. The female flowers have imperfect anthers; the male have a style like that of the female, only its branches are minutely papillose externally, as in Weddell's *S. iodopappus*. The style in the female flowers, instead of resembling that of

the hermaphrodite blossoms of Senecio generally, imitates that of the ray-flowers of the genus.

SENECIO EVACOIDES, Schultz Bip., is also in the present collection, but with a pappus the bristles of which are indistinctly, if at all, barbate at the apex.

SENECIO PELLITUS (sp. nov.): subdioicus? manus, herbaceus, surculosus, acaulescens, undique pilis longis sericeis dense crinitus; foliis rosulatis obovatis vel subrotundis integerrimis sub-3–5-nerviis in petiolum brevem attenuatis; scapo brevi vel subnullo monocephalo; involucro 20-phyllo ecalyculato; ligulis nullis; floribus creberrimis; styli ramis obtusis (nec truncatis) hirtulis; acheniis glabris; pappo rigidulo. — High Andes of Peru near Casa Cancha. The flowers in the specimens are structurally hermaphrodite; but the anthers bear very little pollen, and the style resembles that of the female flowers of *S. diclinus*, &c., to the same group with which this species evidently belongs.

SENECIO WERNERIOIDES, Wedd. Chlor. And. I. p. 128, t. 19.

Var. β. EXSCAPUS: capitulo inter folia rosulata creberrime pinnatifido-dentata sessili. — Alpamarca, high Andes of Peru.

Var. γ. SCAPOSUS: scapo multibracteato 3-pollicari folia spathulata simpliciter dentata subæquante. — At a lower elevation, between Culluay and Obrajillo.

Bilabiatifloræ.

ONOSERIS ODORATA, Hook. & Arn. To this species (which includes *O. Cumingii*, Hook. & Arn.) belongs the *Cursonia Peruviana* of Nuttall. The bristles of the pappus, said by De Candolle to be biserial, are better described by Don as in a triple order, the innermost much larger and stouter, the outermost very short.

HYALIS ARGENTEA, Don. The receptacle is naked, with broad areolæ, between which one or two minute setulæ may often be found; these hardly answer to the character "fimbrillis callosis singulis sub achenio singulo." Pappus no more connate at the base than in all the allied genera, pluriserial, the bristles denticulate. Tails of the anthers plumose with cobwebby hairs. A more remarkable addition to the generic character, — one which rather militates against Weddell's group of *Plazieæ*, — is that the corollas, although more commonly uniform and bilabiate, are not rarely, in one or more of the flowers of the head, deeply and equally five-parted, the lobes narrow and revolute, — in this and in some other respects indicating an affinity with Weddell's genus *Aphyllocladus*.

CHÆTANTHERA PERUVIANA (sp. nov.): annua, tenella, diffuse ramosa; foliis lineari-cuneatis vel spathulatis versus apicem spinuloso-dentatis laxe villosis mox glabratis, summis angustioribus circa capitulum confertis; involucri squamis subscariosis retusis, exterioribus ovalibus, costa in appendicem nunc folioformem producta, interioribus lineari-oblongis sæpe mucronulatis; ligulis linearibus fere glabris involucrum vix superantibus, labio interiori parvo brevi apice bidentato. — Andes of Peru, above Baños. Near *C. tenella:* the first species detected north of Chili.

ORIASTRUM COCHLEARIFOLIUM (sp. nov.): pulvinatum, laxe arachnoideo-lanatum; foliis in caules breves confertis imbricatis sessilibus crassis obtusissimis muticis dorso mox glabratis intus sub margine incurvo concavis lanuginosis, inferioribus oblongis, superioribus spathulatis capitulum sessile arcte rosulato-cingentibus; involucri squamis omnibus scariosis, apice radiante colorato ovato-lanceolato acuto rigidiori; pappi setis capillaribus rigidis basim versus parce barbellulatis superne fere lævibus. — Alpamarca, high Andes of Peru. A very distinct species, interesting from its extending the range of the genus farther north than before. Ray-flowers perhaps fertile; their linear ligule obscurely tridenticulate at the apex, and with two minute teeth at the base on the inner side, representing the lower lip. Mature achenia unknown. — Those of *O. Chilense*, Wedd., are pyriform; the papillæ of their surface when soaked swell into a jelly, and then the achenium appears as if glabrous. Its pappus in the ray-flowers, generally of two or three caducous bristles, is sometimes wholly wanting; that of the disk-flowers is nearly uniserial, the bristles united at the base into a ring. They are finer and softer than in *O. pusillum;* but it is not worth while on this account to keep up *Aldunatea* as a section. — *O. pusillum* has abortive stamens in the ray-flowers, not before noticed, still more approximating the genus to *Tylloma* and *Egania*, which last might well enough be referred to *Oriastrum*, and even both, perhaps, back to *Tylloma*.

A serious error in transcription vitiates Weddell's amended character of *Oriastrum*, i. e. the achenia of the disk, instead of those of the ray, are said to be glabrous and effete; those of the ray, instead of those of the disk, papillose and fertile.

JUNGIA FERRUGINEA (Linn. f.): scandens vel sarmentosa; foliis 5–9-lobatis subtus pannoso-villosis; capitulis 5–10-floris glomerulatis, glomerulis in corymbos vel thyrsos congestis; squamis involucri

interioribus paleisque arcte involutis flores et pappum subæquantibus; acheniis glabris. Bogota, Mutis? Holton. Quito, Jameson, Couthouy, &c.

JUNGIA PANICULATA (*Dumerilia paniculata*, DC. *Jungia ferruginea*, Don et auct., non Linn. f. *J. spectabilis*, Less., non Don.): fruticosa; foliis subtus tomentosis, tomento albido implexo; capitulis conferte cymosis plerisque pedicellatis multifloris; involucri squamis interioribus paleisque floribus "luteis" pappoque subdimidio brevioribus; acheniis pilosiusculis. Petioli nunc nudi nunc basi quasi stipulati. — Peru. — I suppose (although I cannot now verify the supposition) that Linnæus received his *J. ferruginea*, along with most of the new species from "America Meridionali" described in the Supplement, from Mutis, therefore probably from Santa Fé de Bogota, where Dr. Holton collected what is manifestly the Linnæan species. In this species the individual heads, only 5 – 10-flowered, are commonly so closely clustered in fascicles as to explain, if not to justify, the view taken by the younger Linnæus of a compound capitulum. The Peruvian species referred by Don to *J. ferruginea* is quite different. De Candolle's (but not Don's) *J. spectabilis* is the same as his *Dumerilia paniculata* without the stipular appendages, which are inconstant.

PEREZIA. Dr. Schultz goes too far when he refers the Mexican and North American species of this extensive genus to *Trixis*. In the former even the fewest-flowered species have a gradated imbricate involucre and erostrate achenia. The latter has a uniserial involucre, the scales all of the same length, with or without a circle of spreading, mostly foliaceous bracts.

To *Trixis frutescens* I refer *T. paradoxa*, Cass., *T. cacalioides*, Don, and *T. Neæana*, DC. *T. angustifolia*, DC., which is probably a narrow-leaved form of the older *T. corymbosa*, Don, is known by the linear-lanceolate scales of the involucre gradually tapering to a point, the margins of the leaves usually revolute. *T. obvallata*, Hook. & Arn. probably belongs to *T. longifolia*, Don.

Cichoraceæ.

ACHYROPHORUS CHONDRILLOIDES (*Oreophila chondrilloides*, Don in herb. Hook. *Seriola Brasiliensis*, subvar. b., Hook. & Arn. Comp. Bot. Mag. I. p. 30): glaucescens, undique glaberrimus, radice fusiformi; caule folioso stricto mono – oligocephalo; pedunculis elongatis; foliis subcarnosis lineari-lanceolatis integerrimis seu obsoletissime denticulatis, superioribus subamplexicaulibus, imis in petiolum basi dilatatum sensim angustatis; involucri squamis lanceolatis subacutis. — Rio Negro, North Patagonia, in saline soil.

ACHYROPHORUS SESSILIFLORUS (*A. Quitensis*, Schultz Bip. Wedd. with *A. Humboldtii* and *albiflorus*, Schultz), a widely variable species, must include not only *A. sonchoides*, DC. (the most caulescent form), but also a

Var. β. BARBATUS (*A. barbatus*, Schultz Bip. Rev. Crit.): minor; involucri phyllis exterioribus superne pl. m. setosis.

Var. γ. SUBRŬNCINATA (*A. setosus*, Wedd. & *A. eriolænus*, Schultz Bip.): foliis runcinato-dentatis vel incisis margine sæpius setuloso-ciliatis; involucri phyllis exterioribus oblongis seu obovatis dorso setosis vel nudis. Ludit, 1, involucro tomentoso, 2, foliis rhombeo-ovatis longius petiolatis.

ACHYROPHORUS STENOCEPHALUS, Gray (including *A. taraxacoides* Wedd.) is perhaps only an extreme variety of the preceding. Meyen's specific name was *taraxacifolia*, which Walpers, perhaps accidentally, changed to *taraxacoides*, which name both Weddell and Schultz cite under *A. Meyenianus* (which is most probably a form of *A. sessiliflorus*) as well as under the present species, showing some confusion, to avoid which I have retained the appropriate name of *A. stenocephalus*.

PICROSIA LONGIFOLIA, Don. The pappus is fulvous and soft, not fragile, and the genus is probably nearest related to *Pyrrhopappus*.

FITCHIA NUTANS, Hook. f. Of this curious arborescent Cichoracea Professor Dana collected a single specimen on the mountains of Tahiti, which is about 25 degrees of longitude farther east than Elizabeth Island, where it was discovered by Mr. Cuming. The single capitulum in the collection being male adds nothing for the completion of the character of the genus. The plant from which it was taken is said to be a tree, with yellow flowers.

2. *Notes on Lobeliaceæ, Goodeniaceæ, &c. of the Collection of the U. S. South Pacific Exploring Expedition.* By ASA GRAY.

Lobeliaceæ Sandwicenses. The Sandwich Islands are remarkable for their arborescent, shrubby, or fleshy-stemmed Lobeliaceæ. The species are numerous and peculiar, but very difficult to investigate in herbaria, owing to the imperfection of materials in collections and to the injuries from insects to which these and other lactescent plants are especially liable. There are moderately good materials extant in different collections of ten or eleven species, and indications of almost an equal number; while many others doubtless remain to reward the labors of future explorers of the forest region of Hawaii, a large part of which lies still untrodden by the naturalist. Exclusive of three true Lobelias, and of a striking new *Isotoma?* of Kauai or Nihau in Remy's collection, the known species of the Sandwich Islands may all be referred to Gaudichaud's genera *Delissea*, *Cyanea*, and *Clermontia*, three genera which also shade off into each other in a somewhat troublesome manner. The only essential character of Gaudichaud's genus *Rollandia*, viz. the adnation of the stamineal tube with one side of the tube of the corolla, is as I suppose a mistake. At least it does not occur organically in flowers of the plants which well accord with the (now flowerless) specimen of *R. lanceolata* collected in Freycinet's voyage, upon which Gaudichaud founded the genus, nor, I believe, in the plant which answers to his more miserable specimen of *R. crispa*. The former is a good *Delissea;* the latter, having larger and somewhat foliaceous calyx-lobes, is one of the species through which *Delissea* graduates into *Cyanea*. To the latter genus we may confidently refer Presl's *Macrochilus* (*Lobelia?*) *superba*, Cham., of which the calyx-lobes are probably incorrectly said to be imbricated in æstivation, and also a new and most remarkable arborescent species, which by its extremely long and apparently petaloid calyx-lobes, equalling the corolla in length, approaches *Clermontia;* but these divisions are perfectly separate down to the ovary, almost filiform, spreading in anthesis, and not deciduous. Our *Delisseæ* are: —

1. DELISSEA LANCEOLATA. *Rollandia lanceolata*, Gaud. Bot. Voy. Freyc. *R. montana* on the plate, the upper leaves reduced in size. *R. lanceolata* var. *grandifolia*, A. DC. Prodr. is really just the type of the species, which Gaudichaud characterizes as having "foliis magnis."

2. DELISSEA CLERMONTIOIDES, Gaud. Bot. Voy. Bonite, t. 47, which may probably also be *D. Kunthiana*, t. 77, and even *Rollandia Humboldtiana*, of the same author, t. 76.

3. DELISSEA DELESSERTIANA. *Rollandia Delessertiana*, Gaud. l. c. t. 75. We have what may be a variety of this species, *pinnatiloba*, from Kauai.

4. DELISSEA CORIACEA (sp. nov.): fruticosa, glabra; foliis amplis (pedalibus et ultra) oblongo-lanceolatis coriaceis repando-serrulatis basi

acutis longiuscule petiolatis, venulis conspicue reticulatis; racemis plurifloris petiolum haud superantibus; calycis limbo obsoleto seu dentibus 5 minutis instructo; corolla pollicari subcurvata. — Kauai, Remy.

Var. β. foliis spathulato-lanceolatis in petiolum brevem longe attenuatis. — Crater of East Maui. Fruit as large as a cherry.

5. DELISSEA OBTUSA (sp. nov.): suffruticosa; ramis junioribus floribusque undique pubescentibus; foliis (5–6-pollic.) membranaceis oblongis serrulatis apice vel utrinque obtusis subtus parce pubescentibus; racemis plurifloris petiolum gracilem haud superantibus; calycis limbo fere obsoleto; corolla gracili subpollicari incurva. — Mountains of Maui.

Var.? MOLLIS: caule crassiori; foliis elongatis (subpedalibus) oblongo-lanceolatis basi in petiolum breviusculum attenuatis supra pubrulis subtus molliter pubescentibus; "floribus pollicaribus crassiusculis cæruleis." — Mouna Kea, Hawaii. — Possibly both may be varieties of the following.

6. DELISSEA ACUMINATA, Gaud. Bot. Freyc. p. 457, t. 76. — Oahu.

Var. ANGUSTIFOLIA: foliis elongato-lanceolatis aut angustatis aut latiusculis. *D.* (*Lobelia*) *angustifolia*, Cham., DC. — Oahu.

7. DELISSEA UNDULATA, Gaud., to which belongs *D. subcordata* of the same work; leaves with the base subcordate, obtuse, or acute being found on the same stem. The small protuberances on the tube of the corolla represented by Gaudichaud occur in all the forms, but are inconstant.

8. DELISSEA? PLATYPHYLLA (sp. nov.): caule fruticoso orgyali petiolisque tuberculis aculeisve conicis mollibus obsitis; foliis sesqui–bipedalibus obovato-oblongis repandis membranaceis glabris; pedunculis axillaribus brevibus crassis paucifloris: lobis calycis glabri brevissimis subulatis. — District of Puna, Hawaii. The port is rather that of *Cyanea*, and the resemblance to Gaudichaud's *Rollandia crispa* is not remote.

To *Cyanea*, Gaud., distinguished by the foliaceous or enlarged and persistent lobes of the calyx, I refer all the following: —

1. CYANEA GRIMESIANA, Gaud. l. c. t. 75. — Oahu. The corolla is variously stated to be "bluish rose-color," or "white striped with reddish-purple externally."

Var.? CITRULLIFOLIA: foliis bipinnatipartitis, segmentis sinuatis; caule aculeis conicis creberrimis horrido. — Mouna Roa and Mouna Kea, Hawaii. Flowers unknown.

2. CYANEA ASPERA (sp. nov.): foliis oblongo-ovatis acuminatis

denticulatis subtus ad venas venulasque ochraceo-hirtellis utrinque setulis basi papillatis asperis, petiolo muricato; calycis glabri lobis ovalibus obtusissimis foliaceis tubum elongato-obconicum æquantibus; corolla 2½-pollicari curvata. — Oahu. (Leaves of one or two seemingly allied species were collected, without flowers or fruit.)

3. Cyanea ? pilosa (sp. nov.): caule frutescente; foliis subpedalibus membranaceis obovatis utrinque acutis vel acuminatis eroso-crenatis pilis brevibus mollibus hirsutis; racemis brevibus in pedunculo 1 – 2-pollicari hirsutissimo paucifloris; floribus "parvis griseo-cæruleis" pedicellisque glabris; lobis calycis linearibus foliaceis ovario oblongo æquilongis. — Mouna Kea, Hawaii. This and the preceding are doubtless related to Chamisso's *Lobelia calycina*, *ambigua*, and *pinnatifida*, — obscure species, referred by Presl and De Candolle to *Delissea*, but by their foliaceous calyx-lobes apparently effecting a transition to *Cyanea*. The next species, of which materials are also incomplete, is equally ambiguous.

4. Cyanea ? Rollandia (*Rollandia crispa*, Gaud. *Lobelia calycina*, Cham. ?): fruticosa; foliis sesqui – tripedalibus obovato-lanceolatis inferne longe attenuatis breviter petiolatis membranaceis fere glabris margine serrulatis undulatis vel integerrimis; pedunculo petiolum adæquante superne bracteato paucifloro; floribus cinereo-puberulis; calycis lobis oblongis seu lanceolatis foliaceis ovario æquilongis; corolla sesquipollicari; fructu pyriformi pollicari. — Oahu.

5. Cyanea tritomantha (sp. nov.): caule simplici arborescente orgyali; foliis lato-lanceolatis membranaceis subintegerrimis fere glabris basi acutis tripedalibus (incl. petiolo crasso 5 – 8-pollicari); floribus "confertis" magnis; calyce pubescente, lobis linearibus pollicaribus foliaceis ovario cylindraceo longioribus; corolla tripollicari extus tomentoso-pubescente in segmenta 3 longo-linearia mox divisa. — Mouna Kea, Hawaii.

6. Cyanea superba, *Lobelia superba*, Cham. *Macrochilus superbus*, Presl. — Oahu.

7. Cyanea leptostegia (sp. nov.): glabra; foliis ad apicem caulis simplicis arborei confertis lanceolatis subsessilibus integerrimis undulatis (bipedalibus et ultra); racemis brevissimis confertifloris; calycis segmentis prælongis e basi latiori angustissime linearibus patentibus corolla gracili longioribus persistentibus. — Upper edge of the forest near the tabular summit of Kauai. Calyx-lobes fully two inches long, and, except at their broader base, less than half a line wide!

Of *Clermontia*, Gaud., the specimens examined are reducible to two species, viz.: —

1. Clermontia grandiflora, Gaud., with its several varieties,

Var. *α*. brevifolia (*C. grandiflora*, Gaud. Bot. Voy. Freyc. p. 459, t. 73): foliis membranaceis ovalibus leviter obovatis ovatisve utrinque angustatis vel acutatis modice serratis bi–tripollicaribus, petiolo gracili pollicari. — The flowers are evidently amplified or exaggerated on Gaudichaud's plate.

Var. *β*. oblongifolia (*C. persicæfolia* and *C. oblongifolia*, Gaud. l. c. t. 71, 72): foliis oblongis seu elongato-oblongis sæpe obtusis deorsum attenuatis repando-serratis 4–6-pollicaribus, petiolo bi–tripollicari.

Var. *γ*. longifolia (*C. grandiflora*, Hook. & Arn. *C. Kakeana*, Meyen in Presl. Lob. *C. macrophylla*, Nutt. *C. macrocarpa*, Gaud. Bot. Voy. Bonite, t. 49. *C. viridis*, Gaud. ined. in herb. Mus. Par.): foliis subcoriaceis vel membranaceis oblongo-lanceolatis seu anguste oblongis creberrime serrulatis 3–9-pollicaribus basi in petiolum 1–2-pollicarem attenuatis.

2. Clermontia parviflora, Gaud. ined. (*C. oblongifolia*, Hook. & Arn., non Gaud. *C. Byroni*, *pyrifolia*, seu *parviflora*, Gaud. in herb. Mus. Par.): fruticosa, glabra; foliis membranaceis lanceolato- vel subspathulato-oblongis breviter acuminatis crebre repando-serrulatis; pedunculo paucifloro pedicellisque brevibus petiolum haud superantibus; floribus vix pollicaribus gracilibus leviter curvatis "cæruleis"; calyce breviter 5-lobo corollam hinc alte fissam æquante. — Hawaii (and Oahu?), first collected by Macrae.

There are three species of true, fleshy-frutescent Lobelias, viz.: —

1. Lobelia macrostachys, Hook. & Arn. Bot. Beech. Voy. p. 88; Gaud. Bot. Voy. Bonite, t. 46. — Oahu and Hawaii. Gaudichaud's plate exhibits flower-buds only. These when fully formed are 1½ to 2 inches long and mostly recurved; the developed corolla 2 or 3 inches long, "pale" or "white with the summit lilac."

2. Lobelia Gaudichaudii, A. DC.; Gaud. l. c. t. 45. — Oahu.

Var. Kauaensis: racemo puberulo; calycis viscosi lobis brevioribus, i. e. tubo paullo longioribus. — Kauai. "Corolla pale, with pink veins."

3. Lobelia neriifolia (sp. nov.): caule fruticoso crasso medulla farcto; foliis confertis elongato-linearibus utrinque angustatis in petiolum attenuatis coriaceis transverse venosis margine integerrimo revolu-

tis supra glabris subtus incanis; racemo virgato densifloro; bracteis lobisque calycis subulato-setaceis; corolla rectiuscula cærulea. — East Maui. Leaves a foot or less in length, only a third or half an inch long. Capsule dehiscent through the short and obtusely conical vertex.

Scævolæ Polynesiæ. The collection contains,

1. Scævola Lobelia, Linn., De Vriese. Coast of all the coral islands, and of the Feejees, &c.

2. Scævola sericea, Forst., of which *S. plumerioides*, Nutt., of the Sandwich Islands, is a variety with ample and almost glabrous leaves. Tonga, Samoan Islands, &c.

3. Scævola coriacea (Nutt.): fruticosa, decumbens; axillis brevissime barbatis; foliis parvulis carnoso-crassis obovato-spathulatis in petiolum brevem attenuatis aveniis sæpe retusis; pedunculis axillaribus uni- (raro tri-) floris; calycis limbo truncato vel obscure quinquelobo; corollæ lobis lineari-lanceolatis, alis angustis. — Sandwich Islands.

Var. α. (*S. coriacea*, Nutt. in Trans. Amer. Phil. Soc. n. ser. 8, p. 253): cinereo-puberula vel glabella; foliis integerrimis; corolla extus glabra vel pilosula, lobis intus piloso-barbatis. — Kauai and Maui, on sand-hills.

Var. β. corolla intus imberbi extus foliisque glabris. — Nihau, Remy.

Var. γ. foliis cinereo-tomentulosis apice 3–5-denticulatis; corolla extus pubescente, lobis intus glabris. — Molokai, Remy. — To this species probably belongs the Sandwich Island specimen referred by De Vriese to *S. montana*, Labill.; but that species is an upright shrub, with well-developed calyx-lobes.

4. Scævola Gaudichaudi, Hook. & Arn. (non *Gaudichaudiana*, Cham.), includes *S. montana*, Gaud., non Labill., and apparently *S. Menziesiana*, var. *glabra*, Cham. It will probably prove to be only an extreme form of the following polymorphous species; but it has a less developed inflorescence, narrower and somewhat fleshy-thickened, nearly veinless, more entire, and smaller leaves, a more slender and usually glabrous corolla, &c. The flowers of this and the following species are white, not yellow as De Vriese implies. De Vriese's genus *Temminckia*, founded on these Sandwichian species, is said to differ from *Scævola* in the inflorescence not being cymose, nor the filaments bearded, nor the fruit fleshy (baccate). But it would be difficult to find a more purely cymose inflorescence than in these species whenever the peduncle is several-flowered; the filaments are equally beardless in the original and perhaps in every known species of *Scævola*, and the mature fruit is a baccate drupe.

5. Scævola Chamissoniana, Gaud. (a form with pubescent corolla), Hook. & Arn., Cham. (corolla, &c. glabrous), clearly includes *S. Menziesiana*, Cham. (excl. var.), a small-leaved form, either glabrous or pubescent; *S. ciliata*, G. Don; *S. ligustrifolia*, Nutt. l. c. (a form with small and almost entire leaves); *S. pubescens*, Nutt. l. c.; *S. pubescens*, Gaud. in the Paris herb. (with the younger leaves beneath and the inflorescence softly pubescent, the corolla externally pubescent); *S. intermedia*, Gaud. l. c. (with the corolla and the lanceolate nearly entire leaves glabrous); *S. Dielliana*, Gaud. l. c., with larger, puberulent, and sparingly serrate leaves, the peduncle elongated. All are forms of one species, which has more veiny and toothed leaves than the foregoing, mostly slender and often several-flowered peduncles, and broader, broadly wing-margined lobes to the corolla.

6. Scævola mollis, Hook. & Arn., of Oahu, also on Kauai with the leaves not so downy, is well marked by the soft and dense canescent pubescence or close tomentum of the lower surface of the large, oblong-lanceolate leaves, short-peduncled inflorescence, and outside of the corolla. The latter has not a particularly long tube, nor are its lobes unusually pointed.

7. Scævola (Camphusia, De Vr.) glabra, Hook. & Arn. The limb of the more or less curved yellow corolla is nearly equally five-cleft, although some of the lobes are apt to be conglutinate; and the anthers are normal for the genus. The connective is similarly produced in the following species, and, as figured by Labillardiere, in *S. montana.*

8. Scævola floribunda (sp. nov.): fruticosa, orgyalis; ramis puberulis mox glabratis, axillis vix barbatis; foliis lanceolato-oblongis subspathulatis submembranaceis repando-dentatis obscure penninerviis glabris basi attenuata sessilibus vel subpetiolatis; cymis multifloris ex axillis supremis et terminali thyrsum amplum efficientibus; calycis lobis ovatis oblongisve ovario brevioribus; corolla extus incana, lobis intus glabris oblongis; stylo glabro; indusio ciliato extus piloso. — Feejee Islands, where it was also collected by Professor Harvey.

Of *Campanulaceæ* the only thing of interest is

Wahlenbergia Peruviana (sp. nov.): hirtella, humilis; caulibus ramosis diffusis; ramis usque ad apicem foliosis; foliis alternis parvis spathulatis subintegerrimis sessilibus, summis florem bracteantibus; calycis tubo hemisphærico hirsuto lobis oblongis brevioribus; corolla brevi-campanulata ultra medium quinquefida; capsula semisupera, parte libera conico trivalvi. — Andes of Peru above Baños.

3. *Enumeration of a Collection of Dried Plants made by L. J. Xantus, at Cape San Lucas, &c. in Lower California, between August,* 1859, *and February,* 1860, *and communicated to the Smithsonian Institution.* By ASA GRAY.

Such scanty knowledge as we have hitherto possessed of the botany of Lower or Peninsular California was nearly all supplied by the notes and hasty collection made by the late Mr. Hinds, in the voyage of the British surveying ship Sulphur, which touched at the Bay of Magdalena, Cape San Lucas, &c., late in the autumn of 1839. These notes, and an account of the collection, with descriptions of the new species by Mr. Bentham, were published in the Botany of the Voyage of the Sulphur, in 1844. The present collection was made by the indefatigable Mr. Xantus, at San Lucas and the vicinity, while in the employment of the U. S. Coast Survey in charge of a station for tidal observations. Small as this collection is, it contains not a few novelties, and I trust is an earnest of many more. Where the coast furnishes so large a percentage of new species, the interior, and especially its mountains, may be expected to yield a richer harvest to future explorers. Mr. Xantus has already made one successful visit to the mountains within his reach, with very interesting zoölogical results. At the same time he made a good botanical collection, which has most unfortunately been lost.

The numbers in the ensuing list are those under which the specimens have been distributed, as far as the extent of the collection allowed, among leading herbaria, the full set being reserved for the national collection in charge of the Smithsonian Institution.

1. ARGEMONE MEXICANA, Linn.

2. LYROCARPA COULTERI, Hook. & Harv. in Lond. Jour. Bot. 4, p. 76, t. 4. — Radix annua. Folia inferiora cordato-oblonga, repanda, petiolo longo submarginato, superiora brevi-petiolata, dentata vel incisa. Petala latiora quam in exemp. Coulterianis, elongato-spathulata, rosea? post anthesin purpurascentia. Fructus haud maturus.

3. POLYGALA XANTI (sp. nov.): nana, cinereo-pubescens; caulibus adscendentibus e caudice perenni usque ad racemum densiflorum foliosis; foliis ovalibus subaveniis breviter petiolatis; floribus (majusculis) mox recurvis; pedicellis bractea sepalisque angustis æquilongis; alis ovali-oblongis; carina imberbi; fructu ovato sinu profundo emarginato

pubescente. — Caules vix spithamæi, simplices. Folia 4 – 6 lin. longi. Flores 3 lin. longi, albi luteo et purpureo tincti: corolla basi valde gibbosa: stamina 8.

3ᵃ. **Polygala puberula**, Gray, Pl. Wright. 1, p. 40; floribus minoribus.

4. **Ionidium fruticulosum** (Benth. Bot. Voy. Sulph. p. 6, t. 2): var. **dentatum**: caulibus herbaceis 9-pollicaribus; foliis lanceolatis seu linearibus, majoribus argutissime dentatis. — This must belong to Bentham's *I. fruticulosum*, a bad name; for in our plant the stems are wholly herbaceous, and I am not sure that the indurated and stout root is really perennial. The leaves vary from linear to broadly lanceolate, and the larger ones especially are beset with sharp salient teeth. The short peduncles, flowers, &c., accord with the published character and figure.

5. **Drymaria frankenioides**, H. B. K. Nov. Gen. & Sp. 6, p. 21, t. 515; Torr. in Mex. Bound. Surv. 2, p. 36. *Spergularia rupestris*, Benth. Bot. Voy. Sulph. p. 17? non Camb. The leaves are narrower than in the figure above cited, and the small intermediate lobes of the petals are three instead of four; otherwise there is no obvious difference, and No. 698 of Coulter's Mexican collection (from Zimapan) is intermediate in appearance. Without examining the petals the plant might naturally be taken, as I suppose it was by Bentham, for a *Spergularia*.

6. **Drymaria crassifolia**, Benth. Bot. Voy. Sulph. p. 16. *D. polycarpioides*, Gray, Pl. Fendl. p. 12.

7. **Trianthema monogyna**, Linn.; Gray, Pl. Wright. 1. p. 15.

8. **Sida Elliotti**, Torr. & Gray, var.? Gray, Pl. Wright. 2, p. 21. Frutescens.

9. **Abutilon Californicum**, Benth. Bot. Voy. Sulph. p. 8; var. foliis sublobatis discoloribus.

10. **Sphæralcea incana**, Torr. in Gray, Fl. Fendl. p. 23, & Bot. Mex. Bound. p. 39. One of the less canescent forms.

11. **Hibiscus (Bombicella) ribifolius** (sp. nov.): fruticosus, humilis, fere glaber; stipulis setaceis persistentibus; foliis rotundatis subcordatis crenato-dentatis sæpe trilobis chartaceo-membranaceis venulis reticulatis; pedunculis axillaribus unifloris folio longioribus sub apice articulatis; involucello 8 – 9-phyllo, phyllis lineari-setaceis calycis lacinias ovato-lanceolatas subsuperantibus corolla (purpurea?) triplo brevioribus capsulam subglobosam æquantibus; seminibus in loculis

no!

plurimis laxe crinitis. — Caulis subpedalis. Folia semi – sesquipollicaria. Corolla sesquipollicaris. — Most allied perhaps to *H. phœniceus;* but the leaves are all rounded and obtuse, mostly lobed, and resembling those of a Ribes, the corolla much exceeding the calyx and involucel, &c. The young stems and petioles are slightly pubescent; the leaves perfectly glabrous.

12. **GOSSYPIUM**, foliis omnibus integris cordato-ovatis, Benth. l. c. — Like the specimens noticed by Bentham from the same district, destitute of fruit. The leaves of one specimen, however, begin to show lobes. It is probably a cultivated Cotton run wild.

13. **MELOCHIA TOMENTOSA**, Linn. "A common West Indian and Central American species, of which this is probably the northern limit."

14. **KALLSTRŒMIA GRANDIFLORA**, Torr. in Pl. Wright. 1, p. 28: var. **DETONSA**, Gray.

15. **GALPHIMIA ANGUSTIFOLIA**, Benth. Bot. Voy. Sulph. p. 9, t. 5. Apparently *G. linifolia*, Gray, Gen. Ill., is the same species, which extends across the continent on the southern border of the U. S.

16. **KARWINSKIA HUMBOLDTIANA**, Zucc.; Gray, Pl. Wright. 1, p. 32. (= Berland. coll. no. 820, 889, 689, 906, 2340, 2359, 1230, &c.)

17. **MAYTENUS PHYLLANTHOIDES**, Benth. Bot. Voy. Sulph. p. 54. This has also been found on the eastern side of the continent, on the lower part of the Rio Grande, and at Key West.

18. **CARDIOSPERMUM MOLLE**, H. B. K.? A single specimen without fruit.

19. **CARDIOSPERMUM**? sp. nov. A shrubby species, with the habit of Bentham's *Cardiospermum tortuosum*, from the same district, but wholly glabrous and with a different foliage; the fruit unknown, and therefore the genus uncertain.

20. **DODONÆA VISCOSA**, Linn.? Destitute of flowers or fruit.

21. **BURSERA MICROPHYLLA** (sp. nov.): foliolis 14 – 16-jugis cum imparri 2 – 3 lin. longis oblongo-linearibus seu oblongis obtusis sessilibus in rhachi superne marginata; pedunculis 2 – 3-floris brevibus. — (In Sierras Tulè, Sonora, leg. A. Schott, ex herb. Torr.) Frutex rigidus. Folia ad apicem ramulorum brevissimorum conferta. Flores hermaphroditi, an polygami? Petala 5. Stamina 10. Discus 5-lobus. Ovula ex cl. Torrey in loculis solitaria suspensa. Cotyledones contortuplicatissima. — Mr. Schott collected this with a few flowers and young fruit. Mr. Xantus, with fruit only, which is that of a *Bursera.*

22. **Dalea chrysorhiza** (sp. nov.): pilosula; caulibus perpluri-mis e radice annua? filiformibus procumbenti-diffusis; foliolis 7–10-jugis parvis (sesquilineam longis) obovato-linearibus emarginatis subtus nigro-glandulosis; stipulis minimis; pedunculis folia superantibus apice capitato-plurifloris; calycis pubescens dentibus oblongo-linearibus obtusis tubo fere æquilongis. — Radix perpendicularis, ut videtur annua, cortice aurantiaco. Caules pedales et ultra, tenues, parce pilosuli. Spicæ breves circiter 12-floræ; rhachi inter flores glandulis? singularibus fusiformibus acutis obsita. Calyx inter costas glandulosus, lobis cum bractea ovata calyce breviori foliaceis glandula acuta apiculatis. Corolla brevis, violacea. Legumen pilosulum. — A well-marked species of this large, prevailingly North Mexican genus.

23. **Phaseolus filiformis**, Benth. Bot. Voy. Sulph. p. 13. But the whole plant is puberulent. The root is certainly annual.

24. **Phaseolus (Macroptilium) atropurpureus**, DC. Fl. Mex. Ic. ined., & Prodr. 2, p. 395; Torr. in Mex. Bound. Surv. 2, p. 50; var. sericeus. I do not possess any specimen of Dr. Torrey's *P. atropurpureus*, which, described as a new species, may well be identical with its homonyme of De Candolle. Our South California specimens are identical with those of Mr. Schott, from the Rio Grande, dubiously appended to this species by Dr. Torrey, only they are for the most part still more silky-downy. The plant is of the section *Macroptilium*, but has a short calyx. The wings are deeply colored. The root is perennial.

25. **Coursetia? glandulosa** (sp. nov.): foliis ramisque glabratis, petiolo in setam desinente, foliolis ellipticis mucronatis; racemis sæpe fasciculatis sessilibus brevibus plurifloris cum calyce viscoso-glandulosis. — Rami tortuosi, nodosi, nascentes cinereo-villosi. Stipulæ setaceæ, persistentes. Foliola 7–9-juga, haud stipellata, petiolulata, 6–9 lin. longa, 3–4 lin. lata, parce appresso-puberula, mucrone conspicuo. Flores ex axillis foliorum annotinorum orti; racemi brevissimi sæpius bini vel terni; pedicelli conferti, 3 lin. longi. Bractæ parvæ, caducæ. Calyx ebracteolatus, breviter campanulatus, 5-fidus, pilis capitato-glandulosis viscosus; lobis triangulari-lanceolatis acutis, 2 superioribus paullo brevioribus et connatis. Corolla ut videtur pallide lutea; vexillum latissimum, emarginatum, basi biauriculatum, auriculis parvis; carina obtusa alis paullo breviori. Stamina diadelpha; antheræ conformes. Ovarium subsessile, lineare, glanduliferum, 10–12-ovulatum, continuum. Stylus gracilis a medio ad apicem subunilateraliter villosus: stigma capitatum. Legumen ignotum.

26. STYLOSANTHES VISCOSA, *Sw.* (*S. glutinosa*, H. B. K.): var. ACUTIFOLIA.

27. CROTALARIA LUPULINA, DC.

28. CÆSALPINIA MEXICANA (sp. nov.): inermis, glabra; pinnis 3–4-jugis cum impari; foliolis 4–5-jugis; racemis plerumque simplicibus laxis; filamentis inferne villosis petala flava vix superantibus; ovario canescente; legumine glabrato acinaciformi 5–6-spermo. — Var. α. foliolis venosis. In Nueva Leon et Chihuahua, Mexico, Berlandier, no. 941, 2371, Gregg, Eaton & Edwards. Var. β. CALIFORNICA: foliolis plerumque aveniis, coll. Rich. no. 4, & coll. Xantus. — Foliola 6–9 lin., in var. Calif. 3–7 lin. longa, oblongo- vel subrotundo-ovalia. Alabastra 3 lin. longa. Sepala intus sericeo-puberula. Petala 4–5 lin. longa, glabra, suberosa. Legumina acinaciforma vel cultriformia, plana, sesqui–bipollicaria, in spec. Berland. magis oblonga rectiuscula. — This has long been extant in several collections, but we have only now, with the complete specimens of Xantus, fit materials for description.

29. MIMOSA XANTI (sp. nov.): Eumimosa, fruticosa, cinereo-pubescens; ramis aculeis infrastipularibus vel sparsis rarisve armatis: pinnis unijugis; foliolis 5–9-jugis oblongis supra velutino-puberulis subtus canescenti-pubescentibus et præsertim ad margines rhachique strigoso-setulosis; capitulis globosis; bracteolis hispidis corollam quadrifidam æquantibus; calyce parvo hyalino setoso-ciliato. — Legumen ignotum. Pinnæ petiolo duplo longiores. Foliola 3–4 lin. longa, inæquilatera, pennivenia, hinc nervo laterali percursa, setulis validioribus incumbentibus quasi marginata. Pedunculi solitari vel bini, monocephali, semipollicares. — Apparently a well-marked species of the *Castæ* or *Pectinæ* subdivision, not described in Bentham's monograph.

30. LYSILOMA MICROPHYLLA, Benth. in Lond. Jour. Bot. 3, p. 83, & Pl. Hartw. p. 345. Legumen generis, 3–6 poll. longum, 5–8 lin. latum, stipite 2–3 lin. longo. — Berlandier's no. 3144, coll. distributed by Dr. Short, is a Lysiloma, in fruit, belonging to Mr. Bentham's second division; compared with Hartweg's no. 75, in flower only, it appears to be the same species. Therefore the character of *L. desmostachys* may be completed as follows: — Legumen lineari-oblongum, 6–7-pollicare, 1½–2 poll. latum, substipitatum.

31. CALLIANDRA CALIFORNICA, Benth. Bot. Voy. Sulph. p. 14, t. 11. Only a fragment, depauperate, with the pinnæ reduced to a single pair. Stamens bright red.

32. Leucæna macrophylla, Benth. l. c. p. 90? In fruit only; doubtful if Bentham's plant, which was collected at Acapulco, and in flower only. From the pod and the look of the foliage it may be an *Albizzia*.

33. Acacia flexicaulis, Benth. in Lond. Jour. Bot. 1, p. 505. In fruit.

34. Acacia Farnesiana, Willd. — Also foliage of another species, perhaps *A. Greggii*. ✓

35. Œnothera sinuata, Linn., var. humifusa, Torr. & Gray. Except that the flowers are larger, the specimens accord with those from the counterpart peninsula of Florida.

36. Mentzelia aspera, Linn.

37. Turnera Pumilea, L.

38. Fouquieria spinosa, Gray, Pl. Wright. 1, p. 76. *Bronnia spinosa*, H. B. K. Nov. Gen. & Sp. 6, t. 528; Benth. Bot. Voy. Sulph. p. 16. This was collected at Rayon in Sonora by Professor Thurber, but is not enumerated in the Botany of the Mexican boundary.

39. Echeveria farinosa, Lindl. in Jour. Hort. Soc. 4, p. 292, ex Walp. Ann. Bot. 2, p. 669. *E. lanceolata*, Nutt.? sed floribus longe pedicellatis. — The broad-leaved Echeveria collected by Dr. Bigelow in Whipple's Exploration, and referred to *E. lanceolata*, Nutt., is evidently Lindley's *E. laxa*.

40. Loranthus. A species of the section *Notanthera*, *Oscillanthera*, indeterminable for want of foliage.

41. Randia armata, DC.? In fruit only.

42. Mitracarpium lineare, Benth. Bot. Voy. Sulph. p. 20. The leaves vary from linear to lanceolate. Seeds as in *M. breviflorum*, which is probably a form of *M. lineare* with a smaller corolla.

43. Houstonia (Anotis) asperuloides. *Hedyotis asperuloides*, Benth. Bot. Voy. Sulph. p. 19, t. 13. This nearly approaches some of the various forms of *H. angustifolia*; but the capsule is more clavate-turbinate and the seeds are smooth, not pitted.

44. Pectis multiseta, Benth. Bot. Voy. Sulph. p. 20.

45. Pectis (Pectidium) punctata, Jacq. A single fragment, perfectly resembling the West Indian plant.

46. Hofmeisteria fasciculata, Walp. Repert. 6, p. 106. *Helogyne fasciculata*, Benth. Bot. Voy. Sulph. p. 20, t. 14. The leaves are less dissected than in the specimens figured, often cordate-orbicular and obtusely or obscurely lobed, or only crenate, others three-cleft. *H. ure-*

nifolia would seem to differ mainly in the greater number of setæ and paleæ of the pappus. *H. pluriseta* is more different, having much fewer involucral scales as well as flowers, the innermost of the former much broader, the bristles of the pappus, &c. more numerous. The slender and numerous interior scales of the involucre of *H. fasciculata* are deciduous with the flowers.

47. CARPHEPHORUS ATRIPLICIFOLIUS (sp. nov.): caule basi fruticóso; ramis patentibus; foliis oppositis hastatis vel triangulatis plerumque laciniato-dentatis petiolatis utrinque appresso-pubescentibus seu hirtellis; corymbis nudis polycephalis; capitulis circiter 20-floris pedicello brevioribus; involucri squamis oblongis, exterioribus brevioribus cinereo-pubescentibus, interioribus paleisque receptaculi fere scariosis; pappo plumoso albo; achenio piloso; corollis antherisque ut videtur flavidis.—Folia cum petiolo 4 – 6 lin. longo 1 – 2-pollicaria; floralia parva, sessilia. Pedicelli 4 – 8 lin. longi, glanduloso-puberi. Capitula semipollicaria. Involucrum floribus dimidio brevius, squamis leviter striatis obtusiusculis, interioribus glabris. Corolla e tubo brevi extus glandulifero infundibuliformis, glabra, lobis brevibus late ovatis siccitate flavis extus parce hispidulis. Antheræ semi-exsertæ. Stylus basi haud bulbosus; ramis planiusculis obtusiusculis minutim hirtellis. Pappi setæ circa 20, longe et molliter plumosus. — Without the paleæ on the receptacle, which subtend each flower and are rather persistent, this plant would be taken for a plumose *Brickellia*. It is a close congener of the other South Californian species, *C. junceus*.

48. PERITYLE CALIFORNICA, Benth. Bot. Voy. Sulph. p. 23, t. 15; forma biaristata, aristis achenio brevioribus.—The awns of the pappus are less barbellate as well as shorter than in the published figure, and uniformly two in the flowers examined. The achenium is broader than in any other species, being obovate-oblong, with the summit, bearing the pappus, narrow; when mature broadly obovate with a much thickened callous margin, more so than is represented in the figures, or than appears in the younger fruits; the corona of the pappus is much more delicate than is shown in the figure, and dissected into slender hyaline squamellæ.

49. SOLIDAGO (EUTHAMIA) DIFFUSA: laxe ramosissima, subglutinosa; foliis fere filiformibus subcanaliculatis; capitulis oblongis subclavatis; floribus disci 4 – 5, ligulis 0 – 2; alveolis receptaculi paucis longe paleato-productis. *Ericameria diffusa*, Benth. Bot. Voy. Sulph. p. 23. —"Fruticulus humilis" according to Bentham; but our specimens,

although they include not the root or base, seem to be herbaceous. I cannot doubt that the plant is a true congener of *Solidago* (*Euthamia*) *tenuifolia* and *lanceolata*, of which it has the habit (though more loosely branched), involucre, flowers, stigmas, &c. Only the flowers are fewer, and therefore also the fimbrillæ of the receptacle, which are more elongated, chaffy, and combined in the centre of the receptacle. Commonly, however, all the flowers are hermaphrodite and tubular, but one or two of the marginal ones are becoming liguliform and their stamens abortive. This adds another to the many intricate transitions among the Chrysocomeous genera which I have had occasion to notice. If, in any revision, *Euthamia* is adopted as a genus, it may well embrace *Bigelovia* of De Candolle.

50. APLOPAPPUS ARENARIUS, Benth. Bot. Voy. Sulph. p. 24. Folia ramealia oblonga vel lanceolata, caulina (præsertim inferiora) spathulata, magis inciso-dentata quam undulata (dentibus mucrone cuspidatis), ima nunc lyrato-subpinnatifida, majora pollicaria vel paullo longiora. — Mr. Bentham's specimens were probably older, and wanted the lower cauline leaves. In ours the stems are nearly or quite herbaceous.

51. BACCHARIS CÆRULESCENS, DC. Prodr. 5, p. 402. Same as the Northern Mexican plant.

52. BACCHARIS VIMINEA, DC. Prodr. 5, p. 400? This accords with what was named *B. Douglasii* in Whipple's Pacif. R. R. Exploration, and with specimens gathered in California by Fremont in 1845. Although allied to *B. Douglasii*, it is not the same, but I believe is De Candolle's *B. viminea*. The heads are larger and looser than those of *B. Douglasii*; the scales of the involucre broader, the outermost ovate, the innermost oval-lanceolate, smooth, and more scarious. The specimens of Xantus all have the heads diseased or monstrous, probably by the puncture of insects.

53. PLUCHEA SUBDECURRENS, DC.? var. PARVIFOLIA. Folia sesquipollicaria vel breviora, 2½ – 3 lin. lata, fere ad basin usque argute serrulata, basi in alas lineares decurrentia. — This is quite different from Hartweg's no. 112, and probably really belongs to *P. subdecurrens*.

54. FRANSERIA AMBROSIOIDES, Cav. Ic. 2, p. 79, t. 200.

55. FRANSERIA TENUIFOLIA, var. TRIPINNATIFIDA, Gray, Pl. Lindh. 2, p. 227, & Pl. Wright. 1, p. 104. *Ambrosia fruticosa* (excl. β.) and *A. confertiflora*, DC. Canescent forms.

56. **Franseria pumila**, Nutt. A single specimen, without flowers; perhaps a dwarf and more canescent state of the preceding.

57. **Hymenoclea** sp. without flowers or fruit, the branches bearing abnormal growths, incited by the punctures of insects. Doubtless one of the two published species.

58. **Heliopsis buphthalmoides**, Dunal. *H. canescens*, H. B. K. Forma minor.

59. **Aldama uniserialis**, Gray, Pl. Lindh. 2, p. 228. Somewhat depauperate specimens, well agreeing with the Texan plant.

60. **Viguiera deltoidea** (sp. nov.): herbacea, pubero-scaberula, ramosa; ramis polycephalis; foliis inferioribus oppositis, superioribus alternis, omnibus deltoideis vel subcordatis obtusis subintegerrimis longiuscule seu breviuscule petiolatis supra scabris subtus albido-pubescentibus; capitulis corymbosis; involucro biseriali disco breviori, squamis lineari-oblongis obtusiusculis canescentibus; receptaculo breviter conico, paleis latis mucronatis; acheniis præsertim ad margines longe villosis; pappi aristis breviusculis paleis intermediis latis bis terve longioribus. — Folia 1½ – 2 poll. longa, basi 1 – 1½ lata, trinervia; petioli 3 – 6 lin. longi. Pedunculi ½ – 2 pollicares. Capitula semipollicaria. Ligulæ 6 – 8, oblongæ, 10-nerves. Achenia matura fere 2 lin. longa: pappi paleæ ex angulis ortæ lanceolatæ, in aristam hispidam corolla breviorem productæ; intermediæ utrinque 2 latæ vel 1 latissimæ, truncatæ, subintegræ, firmæ, ⅔ lin. altæ. — A well-marked species. Plant apparently more than two feet high, the base of the stem not seen.

61. **Viguiera tomentosa** (sp. nov.): fruticosa; foliis oppositis petiolatis subcordatis (raro subhastatis) sensim acuminatis serratis pube molli utrinque tomentosis subtus incanis; capitulis corymbosis; involucri discum subæquantis squamis 1 – 2-serialibus lanceolatis incanis; receptaculo parvo subconico, paleis lanceolatis muticis; acheniis villosis; aristas 2 longis et squamellas plures parvas gerentibus. — Frutex vel suffrutex ramosus, ramulis junioribus molliter pubescentibus. Folia (cum petiolo 3 – 6 lin. longo) 3 – 5-pollicaria, e basi leviter cordata (nunc truncata, raro hastata) sensim attenuata, argute serrata, basi trinervia; floralia parva, linearia. Pedunculi 1 – 3-pollicaria. Capitula quam præcedentis paullo minora. Ligulæ amplæ, pollicares, circiter 15-nerves. Pappi aristæ subulatæ, achenio æquilongæ; squamellæ intermediæ utrinque 4 – 6 angustæ vel 2 profunde 2 – 3-fida, laciniato-fimbriatæ, aristis multo breviores. — A true *Viguiera*, with the habit rather of *Oyedæa*.

62. Coreocarpus heterocarpus (sp. nov.): annua; foliis membranaceis punctatis bipinnatifidis, segmentis brevibus hinc inde dentatis; acheniis exterioribus obovatis ala pinnatisecta cinctis, interioribus longioribus clavatis plerumque exalatis nunc tuberculosis exasperatis, omnibus calvis. — Herba gracilis, pedalis, capitulis corymbosis, involucro 2 lin. longo, ligulis 2 – 4, lineas 3 longis. — I am confident that Bentham's *Coreocarpus parthenioides*, and his *Acoma dissecta*, along with the present plant, belong to one genus, for which, from its analogy to *Coreopsis*, the name of *Coreocarpus* may be preferred. Its nearest relationship is with *Leptosyne* on one hand, and, still more, with *Chrysanthellum* and *Heterospermum* on the other. In the next complete revision of the Bidentoid or Coreopsoid genera with fertile rays, I expect to see all these four and some others reduced to one (*Heterospermum*), which will be the analogue of *Coreopsis*, and about equally polymorphous in the achenia, &c. — Although the *Coreocarpus* (*Acoma*) *dissecta* is described as a "suffrutex," with linear entire lobes to the leaves, and the achenium with a narrow entire wing, yet I am not sure that it is really distinct from the present plant. The indurated stems and roots of some annuals of a dry region are not rarely described as fruticose; and the achenia of Bentham's plant, I suspect, were far from mature. Yet our specimens are those of a tender and slender annual, and even the ovaries show the rudiments of the lobed wing, which at maturity is dissected in the manner of most *Coreopsides* of the section *Coreoloma*, only more coarsely. The inner disk-achenia are longer and much narrower than the rest, are more or less roughened or tuberculate, and mostly quite wingless. The disk-corollas show a bearded ring at the summit of the proper tube. This Bentham describes, but the artist has neglected to delineate, in his *C. parthenioides*; on the other hand, the artist delineates the same thing in the *Acoma dissecta*, while it is not noticed in the description. Of the latter plant, also, the appendages of the style are described as "vix puberula," while the artist makes them hairy. In our plant these appendages are elongated linear-subulate and minutely hispid.

63. Heterospermum Xanti (sp. nov.): tenue, glabrum; foliorum segmentis paucis angustissime linearibus integerrimis; pedunculis filiformibus; involucri exterioris squamis haud ciliatis interiores vix æquantibus; ligulis 7 – 8 elongatis; acheniis radii calvis ala lobata, disci linearibus longiuscule biaristatis. — Only a single specimen was collected, of a slender annual, 6 or 7 inches high, hardly sufficient for

description, but interesting from the resemblance of the marginal achenia to those of the foregoing plant in the wing, as far as can be judged from the immature state. The disk-achenia, and indeed the whole structure, except the fertile achenia, accord with *Bidens*.

64. POROPHYLLUM GRACILE, Benth. Bot. Voy. Sulph. p. 29. The specimens accord with Bentham's description, except that the involucres are five or six (instead of four) lines in length. Into this my *P. Greggii* appears to pass, with involucres from six to eight lines in length, and with mostly rostrate achenia.

65. DYSODIA SPECIOSA (sp. nov.): fruticosa, glabra, valde ramosa; ramis apice nudis monocephalis; foliis oppositis trisectis, segmentis petiolulatis rotundatis argute inciso-dentatis vel trifidis lobis incisis dentatisve, dentibus nonnullis glandula grossa infraterminali instructis; involucro bracteis subulato-setaceis grosse uniglandulosis cincto, squamis linearibus subulato-acuminatis, ligulis involucrum longe superantibus; acheniis glaberrimis. — Frutex vel suffrutex ut videter ultra-bipedalis, ramis patentibus, ramulis floridis herbaceis gracilibus in pedunculum 1 – 3-pollicarem sub capitulo leviter incrassatum desinentibus. Foliola 4 – 6 lin. longa, membranacea, nunc rigidula, glabra vel tenuissime puberula, aut rotundata grosse inciso-dentata, aut 3 – 5-fida lobis argute incisis. Petioli et petioluli interdum lobulis dentibusve parvis 1 – 2 instructi. Capitulum fere pollicare. Bracteæ tenues, aristatæ, involucrum dimidio breviores. Involucri squamæ 17 – 20, rigidæ, sub acumine setaceo grosse uniglandulosæ, inferne glandulis 2 – 4 juxtamarginalibus elongatis sæpe notatæ. Ligulæ 14 – 16, conspicuæ, aurantiaceæ, oblongæ, semipollicares. Receptaculum breviter hirsutum. Pappus albus, 10-paleolatus, paleolis lato-linearibus 7 – 9-setosis. — A striking species, helping to connect *Clomenocoma* with *Dysodia*. But the involucre is as uniserial as in other *Dysodiæ*. So it also is in *D. montana* (*Clomenocoma montana*, Benth. Pl. Hartw. p. 86, 351), which Bentham is disposed to refer to *D. grandiflora* of De Candolle. It is, I think, distinct from, though strictly congeneric with, that species.

66. GNAPHALIUM LEUCOCEPHALUM, Gray, Pl. Wright, 2, p. 99.

67. MALACOTHRIX PARVIFLORA, Benth. Pl. Hartw. p. 321?

68. MACREIGHTIA INTRICATA (sp. nov.): tenuiter sericeo-puberula, mox glabra; foliis coriaceis cuneato-oblongis retusis leviter triplinerviis parvis (6 – 12 lin. longis). — Intricato-ramosus, ramulis rigidis. Pedunculi fructiferi 3 lin. longi, solitarii. Bacca globosa, magnitudine pruni, calyce crasso-coriaceo trilobo stipata, 6-sperma. — The flowers

are unknown; but the plant must be a *Macreightia*, and the most northern species of the genus.

69. Dicliptera resupinata, Juss.; Nees. in DC. Prodr. 11, p. 474; Torr. Bot. Mex. Bound. p. 125.

70. Sericographis Californica, Gray in Torr. Bot. Mex. Bound. Surv. p. 125. *Beloperone Californica*, Benth. Bot. Voy. Sulph. p. 38. This is very variable in the foliage and pubescence; the leaves on some specimens less than an inch, on others over two inches long; the inflorescence, calyx, &c. sometimes cinereous-puberulent, sometimes conspicuously glandular-pubescent. The corolla is minutely puberulent or glandular. The pedicels vary from one to three lines in length. Sterile base of the capsule twice the length of the seed-bearing portion. Seeds turgid-lenticular, with a very smooth testa.

71. Hyptis laniflora, Benth. Bot. Sulph. p. 42, t. 20. The figure does not represent the wool of the calyxes and pedicels half dense enough: it forms a wide white *nimbus*, more than thrice the breadth of the enclosed flower, the hairs of which, moreover, are beautifully and dendritically branched. — *Hyptis Emoryi*, Torr., from the interior Californian desert, on the upper Colorado, is an allied species, but with furfuraceous-canescent and barely serrulate leaves, and the branched wool of the calyxes also short and furfuraceous.

72. Hyptis tephrodes (sp. nov.): herbacea? erecta, pube brevissima molli undique canescens; foliis lanceolatis acutis obtuse serrulatis in petiolum brevem attenuatis, floralibus subulatis parvis; verticillastris plurifloris laxis approximatis in racemos vel spicas crebriores paniculatas confluentibus; bracteis minutis setaceis; calycibus cum pedicello subæquilongo lana brevi nivea dense vestitis, tubo æquali oblongo-campanulato dentibus setaceis æqualibus; corolla vix calyce longiore. — Folia utrinque tomento appressisimo albido mollia, obsolete venosa, caulina 2-pollicaria, 4–6 lin. lata; ramealia decrescentia linearia. Paniculæ floribundæ, aphyllæ. Calycis fructiferi tubo vix sesquilineam longo. — A well-marked species of this great genus, of the same section with *H. albida*, to which it is considerably related. In both the pubescence of the calyx is dendritic.

73. Tournefortia velutina, H. B. K. Nov. Gen. & Sp. 3, p. 79, t. 201.

74. Heliotropium Curassavicum, Linn.

75. Eritrichium (Rutidocaryum) heliotropioides, Torr. Bot. Mex. Bound. Surv. p. 140. *Antiphytum helitropioides*, A. DC. Prodr. 10, p. 122.

76. Eritrichium angustifolium, Torr. in Pacif. R. R. Rep. 5, p. 363. Accords with no. 500 of Coulter's Californian collection, which is referred to this species by Dr. Torrey. No. 85 of a former collection of Xantus, made in the State of California, is a different species, near to or a variety of *E. crassisepalum*, Torr.

77. Buddleia crotonoides (sp. nov.): tomento albido denso; foliis e basi subcordata ovato-oblongis seu ovato-lanceolatis sensim acuminatis vel acutatis creberrime crenulatis, venis subtus prominulis reticulatis; ramis teretibus; panicula densa pyramidata; capitulis floribusque tomentosis sessilibus; corolla calycem vix superante. — Frutex. Folia 3 – 4-pollicaria, dense ac molliter tomentosa, tomento albo in costa venisque mox fulvello, venulis subtus conspicuis versus margines læte reticulatis. Corollæ sicut calyces extus dense tomentosæ. — Related to *B. Humboldtiana* and *B. cordata*, but distinct in the woolliness, the terete branches, &c. The tomentum probably falls with age from the upper face of the leaves.

78. Eustoma exaltatum, Griseb. in DC. Prodr. 9, p. 51.

79. Quamoclit coccinea, Mœnch.

80. Ipomæa (Pharbitis) Nil, Roth.

81. Ipomæa sinuata, Ort. A form with the divisions of the leaves nearly entire.

82. Jacquemontia abutiloides, Benth. Bot. Voy. Sulph. p. 34.

83. Evolvulus alsinoides, Linn.

84. Solanum elæagnifolium, Cav. Ic. t. 243; Dunal in DC. Prodr. 13, p. 290. *S. Hindsianum*, Benth. l. c.

85. Physalis glabra, Benth. Bot. Voy. Sulph. p. 39. But the leaves are not thickish.

86. Datura discolor, Bernh.; DC. Prodr. 13, p. 541. *D. Thomasii*, Torr. in Pacif. R. R. Rep. 5, p. 362, & Bot. in Mex. Bound. Surv. p. 155. *Stramonia Curassavica*, &c., Herm. Par. Bot. p. 233, cum ic. Cinereo-pubescens. Corolla quam *D. Stramonii* longior. Capsula mox nutans, aculeis gracilibus æqualibus pubescentibus ultrapollicaribus horrida. — I have little doubt that this is the West Indian *D. discolor*, although the name is not appropriate to it. The plant of Professor Thurber from Corralitas, mentioned by Dr. Torrey, is, I suppose, *D. quercifolia*, H. B. K., which has also been collected by C. Wright (no. 527) and others, on the Rio Grande in New Mexico. This bears an erect fruit, the spines of which are unequal (the larger an inch or more in length), compressed, and with dilated bases, glabrous or nearly so.

87. Nicotiana Mexicana, Schlecht. in Linnæa, 15, litt. p. 95? Belongs to the section *Tabacum;* perhaps the same as *N. caudata,* Nutt. Pl. Gamb.

88. Nicotiana ipomopsiflora, Dunal. (Moç. and Sesse. Ic. Mex.) in DC. Prodr. 13, p. 559. *N. Tabacam,* var.?? Benth. Pl. Hartw. no. 205. *N. trigonophylla,* Dunal. in DC. l. c. p. 562. "*N. multiflora,* Nutt. Pl. Gamb.?" (sed ubi?) Torr. in Pacif. R. R. Rep. 5, p. 362?—A common North Mexican species extending into the United States, rather variable, but well marked. When fully developed the fruiting racemes are long, virgate, and unilateral, and the corolla (6 or 8 lines long) is white or greenish-white, or yellowish, with a small five-angled border. The whole plant is viscid. It is no. 579 of Coulter's Californian, and 1255 of his Mexican collection. It occurs in Wright's first Texan-New-Mexican collection without a number (unless the number is lost from my set), in his later collection it is no. 1607. Wright also collected it in Texas as early as the year 1848; also Lindheimer, in his coll. 1850 (300), "*N. rupicola,* Lindh. mscr."; Dr. Gregg in Mexico (no. 61, and without a number); Thurber in Sonora (no. 987); and Dr. Bigelow in the interior of California. I believe it is also Berlandier's no. 1361, from San Louis Potosi; but the specimens (in fruit) are too poor to determine. No. 75 of Xantus's Fort Tejon collection is of a different but allied species, perhaps *N. sordida,* Lehm. I cannot find any "*N. multiflora*" in Nuttall's paper on Gambell's collection.

89. Lycium brevipes, Benth. Bot. Voy. Sulph. p. 40; Miers, Ill. S. Amer. Pl. 2, p. 117, t. 69.

90. Vallesia dichotoma, Ruiz & Pav. ex Benth. Bot. Voy. Sulph. p. 33. Leaves lanceolate-oblong, even the nascent ones glabrous.

91. Asclepias subulata, Decaisne?; Torr. in Pacif. R. R. Rep. 5, p. 362, t. 7, & Bot. Mex. Bound. p. 164.

92. Böerhaavia erecta, Linn. A slender form, not uncommon in Sonora, Western Texas, &c.

93. Böerhaavia spicata, Chois.?; Torr. in Bot. Mex. Bound. p. 171. This is most allied to *B. Wrightii.* The lowest leaves are ovate or oblong and obtuse, but the upper ones narrower and cuspidate-acute, often attenuate-acuminate, the margins mostly very undulate, the surfaces brown-dotted. Nothing is more variable than the size of the perianth in this genus. Instead of being small, as in the specimens

described by Dr. Torrey, in the present specimens when well expanded they are three lines in diameter; the fruit from 1¼ to 1½ lines long, usually obtuse, sometimes truncate at the summit; pedicels half a line or a line long. The stamens are 3 or 5.

94. Eriogonum angulosum, Benth. in Linn. Trans. 17, t. 18.

95. Antigonon leptopus, Hook. & Arn. Bot. Beech. Voy. p. 308, t. 69. In some specimens all the upper leaves are subsessile, and the rest short-petioled. Sepals rose-red.

96. Stegnosperma halimifolium, Benth. Bot. Voy. Sulph. p. 17, t. 12. In flower and fruit. But the kernels of the mature seeds have been destroyed by insects, so that the form of the embryo cannot be made out. The ovary shows the rudiments of the dissepiments at the summit of the cell. The five arilli cohere so that, after dehiscence, the contents of the capsule fall as a globular mass.

97. Chenopodium album, Linn.

98. Celosia floribunda (sp. nov.): caule herbaceo (vel suffruticoso?) ramoso fere glabro; foliis coriaceis deltoideo-ovatis nunc subhastatis trilobisve basi in petiolum decurrentibus subtus tomentulosis puberulisve reticulatis; spicis subdensifloris paniculatis, paniculis in thyrsum amplum corymbiformem confertis; floribus plerumque digynis; sepalis albidis ovalibus obtusissimis ecarinatis obsolete 3–5-nerviis bracteas uninerves triplo superantibus; ovulis seminibusque 3–4; utriculo calycem adæquante. — Rami validi, striata. Folia cum petiolo 4–6-lin. longo 2–3-pollicaria, crassa, scabrida, mucronata, ovata seu ovato-lanceolata, nunc integra, nunc subtriloba vel subhasta, lobis rotundatis. Thyrsus maxime floribundus densus. Flores sessiles, vix sesquilineam longi, scarioso-albi, denique fuscescentes. Stamina ima basi monadelpha. Utriculus ovoideus, circumscissus. — This would appear to be allied to the Arabian and Abyssinian *C. populifolia.*

99. Amblogyne (Sarratia) fimbriata. *Sarratia Berlandieri,* var. *fimbriata* (& var. *denticulata?*), Torr. in Bot. Mex. Bound. p. 179.

100. Amblogyne (Sarratia) Torreyi. *Sarratia Berlandieri* & var. *emarginata,* Torr. l. c., non Moq.*

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* Moquin-Tandon's first thoughts, which were to combine his *Sarratia* and *Amblogyne,* seem to have been the best, and, in the next general revision of the order, when the subdivisions come to be grounded upon characters of more consequence than transverse dehiscence or the want of it, will probably be acted upon. *Amblogyne* will thus form a natural and pretty well defined genus, distinguished by the nature of the sepals of the female flowers, their union at the base, which hardens more or

101. **Frœlichia interrupta**, Moq. in DC. Prodr. 13, 2, p. 421.

102. **Mozinna canescens**, Benth. Bot. Voy. Sulph. p. 52, t. 25.

103. **Cnidoscolus angustidens**, Torr. Bot. Mex. Bound. p. 198.

104. **Ricinus communis**, Linn. Cultivated?

105. **Aphora serrata**, Torr. in Bot. Mex. Bound. p. 197.

106. **Euphorbia Hindsiana**, Benth. Bot. Voy. Sulph. p. 51, t. 24. Without flowers or fruit.

The following determinations and notes upon *Euphorbiæ* are communicated by Dr. Engelmann.

107. "**Euphorbia leucophylla**, Benth. Bot. Voy. Sulph. p. 50.

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less, and the separation of the fructiferous calyx from its insertion with the achenium enclosed. The known species may be disposed as follows: —

AMBLOGYNE, Raf. (*Amblogyne* & *Sarratia*, Moq.)

§ 1. AMBLOGYNE vera. Sepala fl. fœm. inferne modice connata, fructifera urceolata- seu infundibuliformi-conniventia apice patentia. Utriculus haud seu vix circumscisse dehiscens.

1. A. polygonoides, Raf. (*A. polygonoides* & *Sarratia Berlandieri*, Moq. in DC. Prodr. 13, p. 268, 270.) Sepala ♀ subspathulato-linearia, subæqualia, trinervata, nervis simplicibus. — Berlandier's specimens of no. 2276 [= 859], on which Moquin founded his *Sarratia Berlandieri*, are very poor, and perhaps did not really afford a circumscissile dehiscence. In these, and in much better specimens of the same species from Bexar (Berlandier's 2411 = 981) I find the utricle to open irregularly or vertically near the base; and the plant clearly belongs to *A. polygonoides*. — The *Amarantus polygonoides* of Wight's Icones Ind. Or., t. 512, is no more an *Amblogyne* than his t. 719. The former probably represents *Euxolus polygamus*.

2. A. urceolata. (*Amaranthus urceolatus*, Benth. Bot. Voy. Sulph. p. 158. *Sarratia urceolata*, Moq. l. c.) Sepala ♀ inæqualia, infra laminam spathulato-orbiculatam [pinnato-] nervosam (nervis ramosis viridibus) 2 exteriora subangustata tricarinata, 3 interiora valde angustata unicarinata.— Bentham makes no mention of a circumscissile dehiscence in this species, nor indeed does Moquin.

Var. obcordata: lamina sepalorum emarginata fere obcordata. *Amblogyne polygonoides*, Torr. in Bot. Mex. Bound. p. 176, quoad pl. coll. Wright, no. 1746. — This, I suppose, is a variety of *A. urceolata* (which I have not seen), with the characters of which it well accords, except that the lamina or dilated summit of the sepals is strongly notched (otherwise quite entire), and nearly obcordate in shape. The utricle is not circumscissile. The pinnately-veined or nervose dilated lamina, and the great contraction below of three of the sepals, at once distinguish this from *A. polygonoides*.

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§ 2. SARRATIA. (*Sarratia*, Moq. pro parte.) Sepala fl. fœm. basi tantum connata, fructifera pl. m. patentia. Utriculus circumscisse dehiscens. Caules erecti.

3. A. fimbriata (*Sarratia Berlandieri*, var. *fimbriata*, Torr. l. c.): caule ramisque virgatis; foliis lineari-lanceolatis; glomerulis globosis in axillis foliorum sessilibus et superne in spicam subaphyllam congestis seu approximatis; bracteis calyce

These specimens, from the original locality of the species, perfectly agree with Bentham's description, but would be called rather grayish-hoary than snow white; the leaves are very deeply and almost pectinately dentate, supported by extremely short petioles; the appendages of the dark red or almost black glands are very unequal, as they commonly are in *Anisophyllum*, and in no species more so than in *E. adenoptera*, Bertol. (*E. dioica*, H. B. K.), the posterior ones being always the largest; in the specimens before me the posterior appendages are one line broad and half as long, the anterior ones scarcely more than half a line broad and somewhat shorter; they are always crenate or

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brevioribus muticis; sepalis ♂ obtusis, ♀ basi connatis subæqualibus e basi angusta (uninervi seu in latioribus obsolete trinervi) in laminam flabellatam tenuiter scariosam radiato-nervosam ambitu fimbriato-incisam (fructif. patentissimam) maxime cuneato-dilatatis. — Valley of the Rio Grande near El Paso, and on the San Pedro, W. Texas, Wright, 582, pro parte. On the Gila River, Schott. Lower California, Xantus, supra, 99. — Nearly diœcious; the female plant only collected, among the flowers of which a male flower, with five narrowly-oblong and obtuse sepals, may rarely be detected. Female sepals more connate at the base than in any of the following.

4. A. Torreyi (*Sarratia Berlandieri*, cum var. *emarginata*, Torr. l. c., non Moq.): dioica; foliis ovato-oblongis seu oblongo-lanceolatis; glomerulis paniculato-spicatis et axillaribus; bracteis sepalisque masculis cuspidato-acuminatis; sepalis ♀ ima basi coalitis subæqualibus obovato-spathulatis uninerviis, nervo simplici seu leviter pinnatim ramoso, apice rotundato integerrimo retuso vel emarginato. — On the Mexican border from the Rio Grande (Dr. Bigelow, Dr. Parry, &c.) to Lower California, Xantus, supra, no. 100. A variety with linear or oblong-linear leaves and virgate spikes was collected near the sources of the Nebraska, by Mr. Henry Engelmann. — I have not seen Dr. Torrey's *S. Berlandieri* var. *denticulata*, with narrow leaves and erose-denticulate sepals, gathered by Thurber at Santa Cruz, Sonora, which seems to connect the present species with *A. fimbriata*.

5. A. scariosa (*Amarantus scariosus*, Benth. l. c. t. 51, *Sarratia scariosa*, Moq. l. c.), from Western Tropical America, I have not seen. From the figure and description it is apparently most nearly related to the foregoing species, but is a much coarser plant, with the "habit and inflorescence of *Amarantus retroflexus*," aristate bracts surpassing the flowers, deeply emarginate sepals to the female flowers and obtuse ones to the male flowers, which is far from the case in *A. Torreyi* if the male specimens in the Lower Californian collection really belong to that species.

6. A. squarrulosa (*Scleropus squarrulosus*, Anderss. ined., from the Galapagos) is another species with the broadly ovate or rhomboid-obovate lamina of the female sepals all abruptly contracted into narrow claws.

The genus *Scleropus* was evidently founded upon an abnormal character, a thickening of the peduncle and pedicels which occurs in various *Amarantaceæ*. Schrader's *S. crassipes* is an *Euxolus*. A part of no. 582 of Wright's Texano-New Mexieven deeply incised, the posterior more so than the anterior ones.* Ovary and capsule together with the styles hairy, but the stipe glabrous: styles longer than ovary, distinct, about two thirds divided: stigmas scarcely clavellate. Seed oval, sharp angled, slightly undulate, nearly 0.5 line long.

108. "EUPHORBIA SETILOBA, Engelm. in Bot. Williamson, Pacif. R. R. Rep. 5, p. 364. Identical with the plant from the lower Colorado, described in the report above cited. Root thick, but evidently annual; many stems from a few inches to a span long, almost verticillate from the very base, an arrangement which is very striking in the Californian *E. polycarpa* and the European *E. Chamæsyce*, but not so distinct in most other *Anisophylla*. Lower leaves coarsely serrate; upper ones entire; in the Colorado plant all nearly entire. Involucra minute, scarcely a third of a line long; the glands perpendicular, not horizontal, dark red, with conspicuous white laciniate appendages. Male flowers 5–8; in the original specimens scarcely ever more than 3. Ovary and capsule covered with short pubescence (not hispid); styles nearly ¼ line long, very slender, their branches remarkably club-shaped; seeds scarcely 0.4 lines long, sharp angled, acute, transversely rugose.—Distinguished from the closely allied *E. polycarpa* by the slit in the posterior part of the involucrum, the shape of the appendages, and the more acute and much more rugose seeds.—*E. setiloba* has also been collected by Dr. Newberry in the sandy deserts west of the lower Colorado river.

109. "EUPHORBIA POLYCARPA, Benth. Bot. Voy. Sulph. p. 50. No doubt identical with the original form, collected in the same neighborhood, but with rather larger leaves than Bentham describes. The specimens referred here by me in Bot. Mex. Bound. p. 186, undoubtedly belong here, as also *E. ocellata*, Nutt. in Hb. Hook., from San Diego, Coulter's no. 1448 in Herb. A. Gray, and specimens collected by Dr. Newberry near Los Angeles and in the Mohave desert. Mr. Boissier, however, distinguished, and perhaps justly, Wright's no. 1854, from

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can collection is *Amarantus Blitum*, var. *græcizans*, in this *Scleropus* condition. As specimens of the same species were mixed with no. 859 in Berlandier's reliquiæ, which number is the equivalent of his 2279, this may have been what Moquin took for *Scleropus crassipes* in De Candolle's herbarium (Prodr. l. c. p. 271), from that collection.

* These petaloid appendages vary, in different specimens, from almost entire or crenulate to laciniate-multifid.—A. G.

the San Pedro River in Arizona, under the name of *E. micromera*, in DC. Prod. ined., by the very small involucres (0.2 lines long), the entire absence of appendages on the small yellow, not purple, glands, and the extremely short styles with subglobose stigmas. The length of the styles in these *Euphorbiæ*, however, is not a very safe character, as this specimen from San Lucas, and some others from Arizona and the Colorado desert prove: they have suberect styles shorter than the ovary (only about ⅛ line long), while most forms from the State of California have elongated styles with divaricate clavate branches, twice as long as the ovary. My remarks about the variability of the plant may be extended to the shape of the leaves, which are usually oval, oblong, or oblong-linear, and obtuse at the base, but in specimens collected by Dr. Newberry at Laguna I find them almost orbicular and deeply cordate at the base. The stipules are divided on the upper, and united on the lower side of the stem, lanceolate-subulate, mostly entire and ciliate, in the specimen from San Lucas, however, glabrous. Stem and leaves usually glabrous, sometimes with a few scattered hairs, or entirely pubescent. The pubescent forms have always very narrow appendages, and the pubescence extends even to the ovary and capsule. The seeds are 0.4 line long, sharp-angled, with the sides almost smooth, or usually more or less distinctly undulate.

110. "EUPHORBIA HYPERICIFOLIA, Linn., var. COMMUNIS, Engelm. in Bot. Mex. Bound. p. 188. *E. Preslii*, Gussone Fl. Sicul. 1, p. 531; Boiss. in DC. Prod. ined. — Boissier's weighty authority has not convinced me that the Linnæan *E. hypericifolia*, with smaller flower-heads, smaller capsules, and smaller and paler seeds, is distinct from our common northern var. *communis*. This latter has become naturalized in Italy, where it has been described under different names (*E. androsæmifolia*, Presl, *E. trinervis*, Bertol., and *E. Preslii*, Guss.); nor can I distinguish *E. lasiocarpa*, Klotzsch, from the West Indies and South America, by any character besides the pubescent capsules. Intermediate forms unite all these forms.

111. "EUPHORBIA GYMNOCLADA (sp. nov.): fruticosa? ramis basi lignescentibus teretibus gracilibus strictis glabratis; foliis rameis ternatis internodio elongato multoties brevioribus linearibus seu oblanceolato-linearibus integris carnosulis (siccitate conduplicatis) subtus puberulis supra subnudis in petiolum brevissimum attenuatis; cymæ terminalis umbelliformis puberulæ radiis ternis iteratim dichotomis; pedicellis bracteas anguste lineares et involucra magna æquantibus; involucri

hemisphærici extus intusque minute puberuli dentibus orbiculato-ovatis fimbriatis dentatisve, glandulis 5 transversis bilabiato-cyathiformibus appendice iis duplo latiore (alba seu rosea) orbiculata integra suffultis; bracteolis paucissimis linearibus fimbriatis; florum masculorum numerosissimorum stipitibus demum exsertis; flore fœmineo breviter stipitato erecto glaberrimo; stylis distinctis ⅔ bifidis ovario æquilongis; ramis clavatis divaricatis; capsulæ coccis globosis; seminibus ovatis obscuris depresso-tuberculatis ecarunculatis. — Base of stem unknown, probably fruticose; the slender branches below ligneous; internodes 2 – 3 inches long. Leaves very deciduous, on the branches in threes, 4 – 7 lines long [the larger almost an inch long], and 1 – 1½ lines wide, on a petiole less than a line long. Cyme 1 – 1½ inches in diameter. Involucres with the large appendages 4 or 5 lines wide. Bracteoles very few (probably 5) outside of the 20 or 30 male flowers. Styles scarcely half a line long. Capsule 2½ lines in diameter; cocci with a slight groove on the back: seeds about 1½ lines long, blackish-brown, covered with flattened tubercles. — Distinguished from the closely allied Mexican *E. peganoides*, Boiss. Cent. Euph. p. 21, by the small size of the bracts, the pubescence of the involucre, the shape of the glands, the large and entire appendages, and the short stipe of the ovary. The seeds of *E. peganoides* are unknown."*

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* Notes to the *Euphorbiæ* of the Botany of the Mexican Boundary Survey, by the author, Dr. Engelmann.

Page 185. *E. petaloidea*, γ. *Nuttallii* is distinguished by Mr. Boissier (Cent. Euph. p. 10) under the name of *E. zygophylloides*, no doubt correctly. Another of Mr. Boissier's new species, *E. polyclada*, from Texas, sent by Wright and Lindheimer, seems to be only a smaller flowered form of *E. petaloidea* with narrower appendages and smaller seeds.

P. 186. *E. cinerascens*, β. *appendiculata* must give way to the earlier name of *E. melanadenia*, Torrey in Bot. Whipp. p. 135. — *E. cinerascens* will have to be named *E. melanadenia*, β. *subinappendiculata.*

P. 187. *E. inæquilatera*, Sonder. A careful examination of the original specimen of *E. serpyllifolia*, Pers. Syn. 2, p. 14, preserved in Herb. De Candolle (a fragment of which has been kindly communicated to me), proves that this is the type of the American forms, referred by me to *E. inæquilatera;* they will therefore have to bear Persoon's name. Mr. Boissier, discriminating perhaps too nicely, considers the Asiatic and African forms as distinct, and comprises them under the name of *E. sanguinea*, Hochst., to which *E. inæquilatera* and many other synonymes are referred.

The following two new species, of the section *Tithymalus*, were collected by Dr. Newberry in the recent expedition under Lieutenant Ives: —

112. Folia pinnata Palmæ cujusdam.

113. COMMELYNA VIRGINICA, Linn.

114. ANTHEPHORA ELEGANS, Schreb. Gram. 2, t. 44.

115. CENCHRUS TRIBULOIDES, Linn., var. *C. pauciflorus*, Benth. Bot. Voy. Sulph. p. 56. *C. echinatus*, Benth. Pl. Hartw. no. 246. Apparently not distinct from the common plant of the eastern side of North America.

116. MUHLENBERGIA CALAMAGROSTOIDES, H. B. K., ex Benth. Pl. Hartw. p. 347. *M. longiseta*, Benth. l. c. p. 28.

117. BOUTELOUA POLYSTACHYA, Thurber. *Chondrosium polystachyum*, Benth. Bot. Voy. Sulph. p. 56. *C. subscorpioides*, C. Müll. in Bot. Zeit. 1856, p. 347. To this belongs no. 754 and 2021 of Wright's Texano-New-Mexican collection, and 792 of Coulter's Californian collection.

118. DACTYLOCTENIUM ÆGYPTIACUM, Willd.

119. Gram. nov. of uncertain genus, the single specimen mislaid.

120. VILFA VIRGINICA, P. de Beauv. Only sterile plants.

121. BRIZOPYRUM SPICATUM, Hook. & Arn. Bot. Beech. Voy. p. 403; Munro in Benth. Pl. Hartw. p. 342. Female specimens with the spikelets an inch and a half long, quite unlike any *Uniola spicata*, Linn., met with on the eastern coast of the United States.

EUPHORBIA SCHIZOLOBA (Engelm. in Lieut. Ives's Rep.): perennis, erecta, glaberrima, glaucescens; foliis breve ovatis integris breviter cuspidatis in petiolum brevem attenuatis; umbellæ trifidæ bracteis inferioribus rhombeis, superioribus transversis cuspidatis; involucri glandulis stipitatis crenatis incisisve nec cornutis, lobis glandulosis emarginatis; stylis ovario longioribus basi connatis. — East of the Lower Colorado, lat. 35°, alt. 2000 feet. Dr. J. S. Newberry, in Lieutenant Ives's Exped., March 26, in flower. — Amply distinguished from *E. montana* and other allied species by the peculiar shape of the glands and lobes of the involucrum. Stems 8 – 12 inches high. Leaves 5 – 7 lines long and 3 – 4 lines wide. Fruit and seeds unknown.

EUPHORBIA LURIDA (Engelm. l. c.): perennis, multicaulis, glaberrima, junior tota lurida; foliis oblanceolatis integris basi angustatis subsessilibus patulis; umbellæ 5-fidæ bracteis cuspidatis, inferioribus obovatis, superioribus suborbiculatis; involucri glandulis transversis crenatis, lobis ovatis membranaceis; stylis ovario multo brevioribus vix basi connatis. — Base of the San Francisco Mountains, lat. 35°, alt. about 7000 feet; in flower at the end of April. Dr. J. S. Newberry. — From the nearly allied *E. esulæformis* it is distinguished by the absence of horns on the glands, &c. Stems of the very young specimens six inches high. Leaves 5 to 8 lines long and 1½ to 2 lines wide. Fruit and seeds unknown.

4. *A Cursory Examination of a Collection of Dried Plants made by* L. C. Ervendberg *around Wartenberg, near Tantoyuca, in the Ancient Province Huasteca, Mexico, in* 1858 *and* 1859. By Asa Gray.

This collection, being made by a person of limited botanical knowledge, contains a number of plants which are common weeds in most warm regions, but also a fair number of new or little known species, — enough to show that this district of country, in which Mr. Ervendberg resides, would well reward a proper botanical exploration, which it is the object of this notice to encourage him to undertake. This Mr. Ervendberg is fully disposed to do, if the possessors of herbaria could be sufficiently interested in this regard, by subscribing for his collections at the usual rates, to defray the necessary expenses. Supplied with proper appliances and facilities, Mr. Ervendberg would make a good, as he is a zealous, collector. The numbers (in parentheses) are those affixed by the collector and under which the specimens have been distributed.

The enumeration, beginning with the *Polypetalæ*, follows something like the Candollean order.

Clematis sericea, H. B. K., a glabrate form (214); *Argemone Mexicana*, L. (292); *Bocconia frutescens*, L. (202); *Cardamine hirsuta*, L. (188); *Cleome polygama*, L. (149); and a single specimen of some other species (136); male specimens only of what seems likely to be a new species of *Mayna* (273); *Prockia Crucis*, L., and fine and abundant specimens of the following: —

Banara Mexicana (sp. nov.): foliis glabris oblongis seu ellipticis breviter obtuse acuminatis a basi biglandulosa 5-costatis; panicula laxa, ramis elongatis pedicellisque velutino-puberulis; perianthio canescente, — "A tree in woods; flowers April to May, white," rather large; the sepals, or outer divisions of the softly canescent perianth, from 2½ to 3 lines long, strictly valvate in æstivation. Mr. Bentham, who has just revised this genus, informs me that he has another Mexican species, *B. dioica*, from near Vera Cruz, but that belongs to another group (121, 247).

Casearia hirsuta, Sev.? (328) and *C. nitida*, Jacq. (338). *Ionidium longifolium*, Moç. & Sesse, but with much shorter peduncles than that species is described (210).

Polygala paniculata, L. (187); and a *Securidaca*, without fruit, appears to be the *S. volubilis*, L. (119); there is also just the northern *Hypericum Canadense*, L. (218).

A broad-leaved *Stellaria* (194) is perhaps a variety of the South American *S. cuspidata; Drymaria cordata*, Willd. (228) could not fail to be in the collection; but a less familiar plant accords with *Glinus Cambessedii* of Fenzl, and no less with *G. parviflorus* of Wallich (271).

The Malvaceæ of the collection are some common species of *Sida*, viz. *S. urens*, L. (297), *paniculata* (203), *carpinifolia* (220), *rhombifolia* (296), and *Elliottii*, Torr. & Gray (176); *Malvaviscus arboreus*, Cav. (289); *Malvastrum tricuspidatum*, Gray (290, 291); *Anoda hastata*, Cav. (331); *Abutilon* (*Wissadula*) *periplocifolium*, Don (151), a form with narrow and tapering leaves, and slightly and bluntly pointed carpels; the "corolla flesh-color" according to the collector's memorandum; also *A.* (*Wissadula*) *mucronulatum* (152), that is, *Wissadula mucronulata*, Gray, Rel. Berland., mscr., & Torr. in Bot. Mex. Bound. p. 39, the flowers of which are said to be "golden yellow." It is no. 3109 of Berlandier's collection, also from Tantoyuca. But if *W. hirsuta*, *rostrata*, and other plants recently referred by Grisebach to *A. periplocifolium* really belong to one species, it may well include the present plant also, which is, perhaps, *Sida hernandioides* L'Her. There is, finally, a true *Abutilon* (161), the species undetermined for the want of fruit, and the following:—

Abutilon notolophium (sp. nov.): fruticosum; foliis lato-cordatis acuminatis integerrimis supra puberulis subtus ramis calycibusque furfuraceo-tomentulosis sæpius ferrugineis; pedunculis axillaribus folium subæquantibus et corymbosis ad apicem ramorum; floribus magnis; calyce quinquangulato; capsula (immatura hirsuta) polycocca, coccis compressis truncatis muticis dorso toto alatis 4–5-spermis demum bivalvibus, ala bipartibili chartacea margine muricato-denticulata, dentibus fasciculo pilorum terminatis.—Hills at Tantoyuca, Mexico, Jan. 1831 ("flores lutei"), coll. Berlandier 743, 2163.—Leaves 3 to 6 inches in diameter. Peduncles 2 to 3 inches long, one-flowered. Calyx an inch long, apparently strongly 5-angled, or as if crested at the base, 5-cleft. Petals an inch and a half long, broadly obovate, veiny. Carpels more than 20, forming a depressed-globular umbilicate fruit of an inch in diameter, separable at maturity, glabrous except on the back; the proper cell small (about 2 lines broad and 3 lines long), and lunate, chartaceous, but the whole produced into a dilated crest or wing, of 3 lines or more in width, which splits into two in dehiscence. Seeds superposed in a single series, puberulent.

Of Bombaceæ, Byttneriaceæ, Tiliaceæ, &c., there is *Eriodendron anfractuosum*, DC. (361); and specimens with male flowers of a tree apparently allied to *Myrodia* (373); *Melochia pyramidata*, L. (269); the ever-recurring *Waltheria Americana*, L. (356); *Guazuma tomentosa*, Kth. (131); *Triumfetta semitriloba*, L. (145); a form of *Heliocarpus Americana*, L. (225); and *Corchorus pilolobus*, Link (the *C. siliquosus* of Torrey and Gray's Flora, &c.), mixed with *C. siliquosus*, L. and *C. villosissimus*, St. Hil. (196, 197).

Amoreuxia Wrightii, Gray, Pl. Wright, 2, p. 26 occurs in a single specimen (124).

Oxalis corniculata, L. (347) could hardly fail to be present.

Vitis Caribæa, DC. (120, 376), *Gouania Domingensis*, L. (279), and a dubious, perhaps unpublished *Euonymus* (139), are solitary representatives of their respective orders.

The Malpighiaceæ are represented by *Galphimia glauca*, Cav. (130, 233), *Malpighia glabra*, L. (183), a *Stigmaphyllon* allied to *S. puberum* (323), and a variety or near relation of *Heteropteris cotinifolia*, Juss. (209).*

Spondias lutea, L. (353), *Bursera gummifera*, Jacq. (344), and *Icica Copal*, Rich. (185) represent the Terebinthaceæ; and *Rourea glabra*, H. B. K. (171), the Connaraceæ.

The Leguminosæ are *Crotalaria sagittalis*, L. (30), *C. incana*, L. (33, 295), *C. anagyroides*, H. B. K. (26); and *C. striata*, DC. (22); *Indigofera subulata*, Vahl (20, 27); *Eysenhardtia amorphoides*, H. B. K. (15, 230); *Dalea nigra*, Mart. & Gal., which is Bentham's *D. lasiostachya* and *D. elegans* of Seemann (7), and the following apparently undescribed species, which abounds in Berlandier's collection: —

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* I append characters of a Mexican Maple, specimens of which were distributed among Berlandier's *reliquiæ*. It is the only Mexican species known to me, and belongs to the same group with *A. saccharinum*.

Acer Mexicanum (sp. nov.): glabratum; foliis subtus pallidis dilatato-cuneatis alte trilobis basi truncatis vel subquinquelobis basi magis rotundatis, lobis parce repando-sinuatis margine integerrimis; floribus umbellato-corymbosis simul cum foliis evolutis polygamis; pedicellis filiformibus barbatis; calyce campanulato subdentato (petalis nullis ?); staminibus 8; fructibus mox glabris, alis parvulis semi-obovatis basi angustatis arrectis. — "Nuevo Leon, in ruderatis, Junio, 1843," Berlandier, coll. no. 3122. Leaves 2 inches in diameter. Wings of the fruit 8 or 9 lines long, but probably not full grown.

Dalea thyrsiflora (sp. nov.): fruticosa, cinereo-pubescens; caulibus erectis paniculato-ramosis; foliolis 3–5-jugis (seu fol. supr. 1–2-jugis) ovalibus membranaceis subtus ramulisque grosse nigricanti-glandulosis; spicis axillaribus et terminalibus breviter pedunculatis thyrsoideo-paniculatis confertis brevibus (nunc inferne sublaxifloris); calyce cum bractea oblongo-ovata acuminata tubo æquilonga grosse glanduloso, dentibus subulato-setaceis villosis demum patentissimis apice uncatis tubo sublongioribus. — Monterey and San Fernando in the northern part of Mexico, and farther south from Victoria to Tula, coll. Berlandier, no. 763, 846, 1386, 2183, 2266. — Shrub 10 feet high, according to Ervendberg; the branches herbaceous. Leaves pale and dull. Leaflets 3 to 6 lines long, obtuse at both ends, copiously dotted underneath with dark glands. Spikes very numerous, on short and slender, often branching peduncles, forming a leafy crowded panicle, the flowers often scattered on the lower part of the rhachis, or a few glomerate in the axils of the uppermost and reduced leaves. Flower about 3 lines long; corolla apparently flesh-color or ochroleucous, scarcely exceeding the lower tooth of the calyx. Legume villous.*

Also *Tephrosia cinerea*, Pers. (19) and *T. Schiedeana*, Schlecht. (307), but with axillary racemes and more acute calyx-teeth.

Diphysa Carthaginensis, Jacq.? (23): the pedicels are long, and the leaflets are emarginate, as in Seemann's specimens from Panama;

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* The other Daleas of Berlandier's collection are: —

Dalea frutescens, Gray (1887); *D. tuberculata*, Lag. (783, 1238, 2203), agreeing with Lagasca's character "foliis canescentibus" better than with De Candolle's; *D. pulchella*, Moric. (782, 1337, 2202); *D. leucostoma*, Schlecht.? but more pubescent, and with fuscous spikes, perhaps Lagasca's *D. virgata*, which is imperfectly characterized (837, 2257 and 761, 2181); *D. triphylla*, Pav. (1214); *D. laxiflora*, Pursh, which is mainly Moricand's *D. penicillata* (1747); *D. pogonathera*, Gray (613, 2023); *D. lasiathera*, Gray (1014, 2444); *D. nana*, Torr. (2053); *D. aurea*, Nutt. (953, 2383, and a very silky variety, 1016, 2446); and the following, which I am unwillingly obliged to describe as new: —

Dalea Berlandieri (sp. nov.): fruticosa, erecta, glaberrima, ramosissima; ramulis gracilibus vix glandulosis; foliolis 2–3-jugis parvis obovato-oblongis cuneatisve retusis subcrassis glaucescentibus subtus rhachique grosse glandulosis; spicis villosis laxifloris; bracteis carnosulis ovato-lanceolatis sensim acuminatis carinatis ciliatis calyce brevioribus deciduis; dentibus calycis e basi lata aristatis villosissimis infra medium denticulis 2 setaceis plerumque instructis tubo campanulato pubescente grosse glanduloso subduplo longioribus; petalis rubescentibus. — In the mountains near San Carlos, Tamaulipas, Berlandier coll. 942, 2372. — Petiole and rhachis 2–5, leaflets 1–3, lines long. Calyx teeth in fruit 3 lines long.

but the latter are from 13 to 19 in number. And the pedicels of Coulter's plant, *D. sennoides*, Benth., are sometimes nearly twice the length of the calyx.

Harpalyce arborescens (sp. nov.): foliolis ovali-ellipticis utrinque rotundatis vel retusis glabratis subtus resinoso-atomiferis; labiis calycis obtusis (18). — The same species, but with adult leaves, which are more coriaceous, I have from Coulter's Mexican collection, ticketed *Harpalyce formosa.* If Mr. Bentham had possessed this when he wrote his little paper on *Harpalyce* in the third volume of Hooker's Journal of Botany, probably he would have distinguished it from the original species, still known only by Moçino and Sesse's drawing. The tapering of the leaflets to the base might indeed have been charged to the rudeness of the drawing, but the drawing plainly represents an herb, while Coulter's and the present specimens are ligneous. Ervendberg's memorandum states that his were taken from "a small tree, growing on high and dry land." The specimens are poor, with very few flowers; these accord throughout with the genus, except that the obovate vexillum bears a pair of small and rather obscure inflexed auricles. The ten stamens are monadelphous, with the tube cleft to the base: the anthers are linear and basifixed.

Zornia diphylla, Pers., var. *reticulata*, Griseb. (12); *Stylosanthes gracilis*, H. B. K.? (11); *Æschynomene Americana*, L. (16); *Desmodium triflorum*, DC. (32, 34), *D. barbatum*, Benth. (31), *D. incanum* or *adscendens*, DC. (43), and two undetermined species (29 and 299).

Piscidia Erythrina, L. (9); some Dalbergieous tree, but the specimens imperfect (28).

Centrosema Virginianum, Benth. (39) and *C. Plumieri*, Benth. (36, 362); *Phaseolus Truxillensis*, H. B. K. (41); *Stenolobium cæruleum*, Benth. (38), and some apparently common *Galactia* (40); *Rhynchosia Caribæa*, DC., with some *R. minima* (35), and *R. reticulata*, DC. (37, 42, 311).

Cassia hirsuta, L. (21), *C. obtusifolia*, L. (24), *C. Humboldtiana*, DC. (25), and *C. patellaria*, DC. (14).

Guilandina glabra, Mill. (229); *Casparea latifolia*, the *Bauhinia latifolia*, Cav. Ic. t. 405, the same as Berlandier's no. 2189.

Neptunia lutea, Benth. (3); *Prosopis* (*Algarobia*) *dulcis*, H. B. K., the same as Hartweg's no. 70 (319); *Mimosa floribunda*, H. B. K. (1), and

Mimosa Ervendbergii (sp. nov.): M. rubicauli simillima, sed villoso-pubescens, aculeis minoribus magis retrorsis armata, setæ interpinnas manifestæ, foliola paullo majora mucrone cuspidata, calyx corolla usque ad medium quadrifida dimidio tantum brevior, lobis hispidulis. Fructus ignotus (2). This is said to be "a shrubby plant, six feet high, growing in the savannas near Wartenberg"; therefore doubtless indigenous. But its resemblance to the Indian *M. rubicaulis* is striking. In the absence of fruit the points above mentioned are all that are observed. The adult leaflets are 4 or 4½ lines in length.

Calliandra Houstoni, Benth. (5) and *C. tetragona*, Benth. (8); *Leucæna pulverulenta*, Benth. (6), mixed with some specimens of *Acacia villosa*, Willd., and *A. glabrata*, Schlecht. Perhaps Lagasca's prior name of *A. penicillifera* belongs to and should be revived for this species (including *A. cuspidata*, Schlecht., *A. hirta*, Nutt., and *A. Texensis*, Torr. & Gray). The unapt name of *A. cuspidata* has been given by Cunningham to a received phyllodineous species. *Acacia spadicigera*, Schlecht. (343) was collected with male flowers only, in a cylindrical-oblong spike, the stamens monadelphous. To this species, rather than to *A. sphærocephala* (if the two are really distinct), should be referred Berlandier's no. 2145, gathered between Tampico and Tula, with mature fruit only. The pod is similar to that of *A. Farnesiana*, only even more thickened, oblong or ovoid-oblong, straight and pointed, 1½ to 2 inches long, the oval and turgid seeds imbedded in pulp.*

Pithecolobium lanceolatum, Benth. in Hook. Lond. Jour. Bot. 3, p. 198 (17); *Inga leptoloba*, Schlecht.? in flower only (4), and *I. eriocarpa*, Benth., perhaps also *I. Xalapensis* (10).

The only Rosaceous plant is a *Rubus*, said to climb 50 feet high, with the main stem an inch thick. It does not well agree with any species in the late Dr. Liebmann's revision of Mexican and Central American Rubi; perhaps it is a form of *R. fagifolius*, Schlecht., with the leaves silky-pubescent underneath.

There are two species of *Eugenia* (193 and 312), the former agreeing with no. 133 of Coulter's collection, from Xalapa.

The Melastomaceæ are an *Arthostemma* (159), *Clidemia pauciflora*, DC.? (138), and *Conostegia Xalapensis*, Don, with the flower-buds conspicuously acuminate (207).

Lythrum alatum, Pursh (300) resembles some of the northern varieties; *Œnothera tetraptera*, Cav. (201) and *Œ. rosea*, Ait. (367) are common Mexican plants.

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* Berlandier's no. 3144 is *Lysiloma desmostachya*, Benth., in fruit. The pods are remarkably large, being from 5 to 7 inches long, 1½ to 2 inches broad, the flat, chartaceous or coriaceo-membranaceous valves neatly falling away from the scarcely thickened persistent margin.

Mentzelia aspera, L. (206) is in all collections; *Gronovia scandens*, L. (149) is not so common, nor is *Turnera Pumilea*, L. (134).

Passiflora fœtida, L. (158^b), *P. serratifolia*, L. (226), and *P. difformis*, H. B. K. (211); *Lagenaria vulgaris*, Ser. (318); *Sicyos angulatus*, L. (306), an *Elaterium?* with only male flowers (258), and male flowers only of another Cucurbitacea (354).

There are four species of *Begonia* (261, 268, 334, 370), which will soon be determinable by the forthcoming (15th) volume of De Candolle's Prodromus.

Eryngium fœtidum, L. (260) and *Helosciadium leptophyllum*, DC. (190, 256, 257) are the commonest subtropical weeds.

Loranthus Schiedeanus, Cham. & Schlecht. is the only representative of that order.

The Rubiaceæ are a doubtful *Spermacoce* (181); *Diodia villosa*, DC. (255); *Richardsonia scabra*, St. Hil. (238) which, by the way, inclines to be naturalized in the United States, and is probably Pursh's *Spermacoce involucrata; Geophila reniformis*, Cham. & Schlecht. (232); the common *Chiococca racemosa*, Jacq. (241); *Psychotria mollis*, Poir.? (246); *Randia Xalapensis*, Mart. & Gal.? (320); flowers of another *Randia* mismatched with leafy branches of a *Casearia* (329); *Bouvardia ternifolia*, Schlecht. (105); *Oldenlandia* (*Gerontogea*, Cham. & Schlecht.) *microtheca*, DC. (200), and fine specimens of the following apparently new species: —

Exostema Mexicanum (sp. nov.): foliis ovalibus acuminatis basi rotundatis vel obtusis breviter petiolatis membranaceis insigniter pinninerviis ramisque glabris; cyma corymbosa composita floribunda floribusque cinereo-puberulis; pedicellis ovario clavato longioribus; calycis limbo brevi quinquefido; corollæ (albæ?) lobis tubo æquilongis. — Arbor elata, foliis pallidis semipedalibus, corollis pollicaribus, æstivatione generis, i. e. quincuncialiter imbricatis, nec valvatis,* antheris anguste linearibus basifixis. Filamenta epigyna, a corollæ libera (125).

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* Weddell, in his tabular synopsis of the *Eucinchoneæ* assigns an æstivation of the valvate type to *Exostema;* but it is not so in the genuine Caribæan species, nor in the present one, which is a manifest congener of *E. Peruvianum.* I know not Bentham's *E. occidentale*, in which the æstivation of the corolla is said to be valvate. The wonder is that the manifestly imbricative æstivation in *Exostema* could have

Mitreola petiolata, Torr. & Gray occurred in the collection without a number. *Valeriana scandens*, L. (357) is one of the commonest of Tropical American plants.

The Compositæ of course are numerous. We have *Vernonia Deppeana*, Less. (46), *V. Schiedeana*, Less., ex Schultz Bip. (51), *V. strigosa*, Schultz Bip. in coll. Linden, mixed with *V. canescens*, H. B. K. (47), and *V. liatroides*, DC., which is 229 of Coulter's collection (70): also *Elephantopus tomentosus*, L. (79, 335); *Elephantosis angustifolia*, DC. (60); *Distreptus spicatus*, Cass. (237); and *Lagascea latifolia*, DC. (317).

Pectis Seemanni, Schultz Bip. in Bot. Voy. Herald, p. 309 (137). = P. Bonplandian

Pectis latisquama, Schultz Bip. in coll. Mex. Schaffn., var. *Berlandieri*: caule pedunculisque elongatis; foliis interdum pinnatifido-dentatis; involucri squamis minus latis spathulato-obovatis. — Pappus in the ray commonly multisetose like that of the disk, but sometimes scanty. This is no. 3159 of Berlandier's collection, from Nueva Leon (63).

Cœlestina ageratoides, var. *latifolia*, DC., apparently *C. corymbosa*, DC. also (100).

Isocarpha oppositifolia, R. Br., the *Dunantia Achyranthes* of De Candolle (72).

Stevia paniculata, Lag., DC., which is the *S. rhombifolia* and *S. origanoides*, H. B. K., and *S. nepetæfolia*, DC. (Berlandier's no. 2273), not of H. B. K. (50).

Brickellia Cavanillesii, Benth., the same as no. 1247 of Berlandier's collection (310).

Eupatorium divergens, Less., which is probably no more than a variety of *E. conyzoides* (54); *E. graciliflorum*, DC., from the character, but the heads are 15-flowered (44); *E. ivæfolium*, L. var. β. DC., with the tips to the scales of the involucre green and decidedly squarrose-spreading; the same as no. 1948 of Fendler's Venezuelan collection (53); *E. collinum*, DC. (52); *E. quadrangulare*, DC., with the flowers more developed than in Berlandier's collection from the same district (340); *E. pycnocephalum*, Less. (*E. Schiedeanum*, Schrad. &c.) according to Dr. Schultz (57); *E. Berlandieri*, DC. (56); and *Critonia daleoides*, DC., or *Eupatorium sessile*, Schultz Bip. (88, 341).

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been overlooked. This rectification of the character leaves my genus *Badusa* to be distinguished almost alone by the dorsifixed and at length versatile anthers, which will hardly be deemed sufficient.

Mikania suaveolens, H. B. K., which is *M. gonoclada*, DC. (82); *M. Houstonis*, Willd., or a plant well agreeing with the character of that species, and with the points mentioned by Bentham in Plantæ Hartwegianæ; but Ervendberg notes it as an erect plant, and the branches are herbaceous (87, 222).

Aster (*Oxytripolium*, Nutt.) *divaricatus*, Torr. & Gray (81); *Erigeron scaposum*, DC. (60); *E.* (*Cænotus*) *linifolium*, Willd. (93); and a species not unlike *E.* (*Polyactidium*, DC.) *delphinifolium*, but with entire leaves (69).

Solidago Canadensis, L., var. *procera*, Torr. & Gray (62); *Heterotheca Chrysopsidis*, DC. (71).

Baccharis cærulescens, DC., a narrow-leaved variety, which is also *B. Alamani*, DC. (48); *B. rhexioides*, H. B. K. (44).

Pluchea subdecurrens, DC.? var. *canescens;* probably a variety of the plant of Xantus, no. 53, from Lower California (p. 160), referred to *P. subdecurrens;* but the leaves are larger (3 inches long by half an inch or more in width), the stem more winged, and both clothed with a tender white woolliness, which, being easily detached, is probably deciduous (343); also the very common *P. odorata*, Cass. (50), *Pterocaulon virgatum*, DC. (59), and *Salmea scandens*, DC. (49, 316).

Polymnia maculata, Cav., which is apparently only a variety of *P. Uvedalia* (206); *Melampodium heterophyllum*, Lag. (80); *M. divaricatum*, DC. (86), and

Melampodium gracile, Less. var. *oblongifolium:* foliis oblongis seu lanceolatis nunc subintegerrimis (*M. oblongifolium*, DC.) nunc sinuato-lobatis vel panduratis (92). — This is from the same district as Berlandier's plant on which *M. oblongifolium* was founded, and is clearly of the same species; but the cauline leaves are mostly sinuate or panduriform, and, although they are not rhomboidal, the plant is pretty clearly a form of *M. gracile.*

Ambrosia artemisiæfolia, L., one of the commonest weeds (168, 180).

Melananthera hastata, Rich., a very small-leaved form, apparently *M. oxylepis*, DC. (77).

Gymnolomia? patens (sp. nov.): vix pubescens; caulibus herbaceis; ramis gracilibus patentissimis oligocephalis; pedunculis filiformibus; foliis membranaceis ovatis vel subcordatis caudato-acuminatis argute serratis trinerviis, petioli gracili; involucri vix biserialis squamis lanceolato-subulatis disco brevioribus; paleis receptaculi submembrana-

ceis rectis complicatis corolla paullo brevioribus achenia compressa calva amplectentibus (95). — This is apparently a congener of Bentham's *Andrieuxia Quitensis* (an unfounded genus, as *A. Mexicana* is a *Heliopsis*) and of his *Gymnopsis? Costaricensis*, as well as of Steetz's *G. vulcanica*, although the broader and emarginate-truncate young achenia are much compressed, and not in the least tetragonal. There is no trace of a pappus. Not to multiply genera upon inconsiderable characters, these should probably all be referred to *Gymnolomia*, Kunth (*Gymnopsis*, DC., excl. *Aldama*). Heads in the present species 3½ lines long; rays 6 to 8, yellow, 4 or 5 lines long.

Aldama (*Gymnopsis*, DC.) *Schiedeana* (98); var. foliis elongato-lanceolatis (99); and *A. uniserialis*, Gray, Pl. Wright., no number.

Simsia lagascæformis, Benth. Pl. Hartw. p. 19, an DC.? (378).

Oyedæa ovalifolia (sp. nov.): scabrida; foliis ovalibus utrinque acutis obsolete denticulatis scabris; involucro disco dimidio breviori, squamis appressis inappendiculatis rotundatis. — Folia submembranacea, 4-pollicaria, triplinervia, rete venarum laxa; petiolo brevi. Capitula iis *O. verbesinoidis* dimidio minora (97). — This is a true *Oyedæa*, the species well marked by the short involucre, the rounded and obtuse scales of which altogether want the foliaceous tips. Rays, achenia, and pappus much as in *O. verbesinoides*, but smaller. The plant was found on the road between Wartenberg and Huaulta, and is said by the collector to "climb high up on trees": there may have been some mistake about this, through some transposition of memoranda.

Bidens tereticaulis, DC., forma foliolo terminali angustiore (67). — Lessing may have been right in referring this to *B. squarrosa* (which I have, as collected by Miss Alderson at Caracas, and which is also Fendler's no. 696), the principal difference being in the smaller size and greater number of the heads. The achenia are similar, and in both ciliate with strong divergent bristles down their whole length. For "apice ciliatis" De Candolle probably meant "versus apicem," but the ciliation extends to the base in Berlandier's as well as in the present specimens. There is, however, in *B. squarrosa* a crown of erect bristles fringing the apex of the achenium, between the awns, of which there is no trace in *B. tereticaulis*.

Verbesina persicæfolia, DC. (84, 91), in which, as in Berlandier's original specimens, the leaves are not "elongato-lineari-lanceolatis" (as indeed the dimensions assigned by De Candolle testify), but oblong-lanceolate or oblong, tapering to both ends.

Verbesina microptera, DC., only a variety of *V. Virginica*, L. (58).

Stemmodontia scaberrima, Cass. in Dict. Sci. Nat. 46, p. 407. *Buphthalmum scabrum*, Cav. *Wedelia hispida*, H. B. K. *Lipochæta Texana*, Torr. & Gray, Fl. N. Am. & Bot. Mex. Bound. p. 92. *Wirtgenia Texana*, Schultz Bip. in Bot. Voy. Herald, p. 304. A form with small heads (89). — Doubtless this is the plant upon which Cassini founded his genus *Stemmodontia*, in the description of which he even indicates the appendages on each side of the base of the achenium. So that *Wirtgenia* of Schultz must give place to *Stemmodontia*, Cass.

An undetermined, apparently new Composita, with the aspect and fertile ligules of *Verbesina*, but with a chaffy pappus (78). Also *Oligogyne Tampicana*, DC. (85).

Dysodia pubescens, Lag., a mere variety of *D. chrysanthemoides*, Lag. (379); *Tagetes lucida*, Cav. (94), and *T. peduncularis*, Lag. (377); and a variety of *Porophyllum ellipticum*, Cav. (75).

Calea urticæfolia, DC. (96); *Tridax procumbens*, L. (61); *Helenium microcephalum*, DC. (76); also a remarkable plant, which, not to multiply genera on single species, I am disposed to append to *Bahia*, viz.: —

Bahia? (*Anisostemma:* eligulata, anisopappa) *nepetæfolia* (sp. nov.): erecta, tomentella, corymboso-ramosa, foliis oppositis deltoideo-ovatis v. subcordatis grosse obtuseque dentatis incisisve subtus albo-tomentosis, petiolo gracili; capitulis conferte corymbosis; involucri squamis ovali-lanceolatis; corollis albis; pappi paleis 3 ad latus exterius linearibus tubum corollæ adæquantibus, 3 – 4 ad latus interius perbrevibus. — Folia 1 – 2-pollicaria, petiolo ¼-pollicari. Pedicelli 4 – 12 lin. longi. Capitula 4 lin. longa, multiflora, homogama. Involucrum laxum, squamis circ. 12 utrinque angustatis dorso carinatis extus tomentulosis disco paullo brevioribus. Achenia gracilia, basi longe attenuata, hirsuta, corollis omnibus tubulosis 5-dentatis (ut videtur albis) longiora. Pappi paleæ fere enerves (65). — Technically this might well enough be taken as the type of a new genus; but if it had rays it would certainly be referred to *Bahia* proper, of which it has the habit and whole general structure. The white, or possibly flesh-colored flowers, with a glandular tube, &c., show an affinity to *Florestina;* — but the opposite leaves, and the capitellate tips of the branches of the style (which accord with *Bahia* § *Eriophyllum*) are quite different. The extraordinary reduction of the paleæ of the pappus on the side toward the centre of the receptacle is constant.

Gnaphalium polycephalum, Michx., is the only Gnaphalineous plant in the collection.

Erechthites hieracifolia, Raf., agreeing with *E. Miradorensis*, Schultz Bip. Pl. Lind. (360); *Neurolæna lobata*, R. Br. (66), and *Neurolæna* (*Schistocarpha*) *Lindenii*, Schultz Bip. in Pl. Lind. ined. (45, 272); *Gynoxys Berlandieri*, DC. (79), which according to Weddell's views would be referred to *Senecio*, notwithstanding the style; *Senecio lobatus*, Pers., which is not only *S. Mississippianus*, DC., but probably also *S. Tampicanus*, DC., not of Gray, Pl. Wright. (90).

Leria nutans, DC. (73) and *L. integrifolia*, Cass.? (74); also *Pinaropappus roseus*, Less. (64).

Lobelia Cliffortiana, Willd., both smooth and hairy forms, the capsule nearly all inferior (249, 30β), and *L. cardinalis*, L., a variety with almost entire leaves (160).

Ardisia Pickeringia, Torr. & Gray in DC. Prodr. Said by Mr. Ervendberg to be common in all the woods and prairies. Accords very well with the plant of Key West. Corolla sometimes with a completely convolute æstivation, rarely quincuncial (216).

Jacquinia racemosa, A. DC.? a form with oblong-lanceolate leaves, 1½ to 3½ inches in length, the tube of the corolla not exceeding the calyx (245, 369).

Plumbago scandens, L. (213).

Plantago Virginica, L., a fertile form with the lobes of the corolla connivent over the fruit, *P. floccosa* of Decaisne being the same with the lobes of the corolla spreading (182).

The Bignoniaceæ are *Bignonia Andrieuxii*, DC.? (166); *Amphilophium molle*, Cham. & Schlecht., a mere variety of *A. paniculatum* (113); *Tecoma stans*, Juss. (103); *T. leucoxylon*, Mart. (also *Tabebuia rosea*, DC.?), said to be "a large tree with rose-red flowers, called Palo de Rosa" (329); an undetermined flowering plant of the order (195, 326); *Martynia diandra*, Glox (114).

The Acanthaceæ are a nearly stemless form of *Elytraria caulescens*, Ledeb. (173); *Blechum Brownei*, Juss. (294); *Dicliptera assurgens*, Juss. (264); *Rhytiglossa dasyclados*, Nees? (349); *Cryphiacanthus angustifolius*, Nees? (109, by error distributed as 104); and *Drejera Willdenowiana*, Nees, the lower lip of the corolla merely three-lobed at its summit (333).

The Verbenaceæ are *Callicarpa acuminata*, H. B. K. (212); *Lantana odorata*, L. (162 in part); a variety of *L. canescens*, Kunth (107);

and an undetermined *Lantana* said to climb 15 or 20 feet high and to have orange-yellow flowers (351); *Lippia dulcis*, Trev. (330); *L. stæchadifolia*, H. B. K. (162ᵃ, 313); *L. callicarprefolia*, H. B. K. (278); *L. myriocephala*, Cham. & Schlecht. (288); *L. geminata*, H. B. K.* (162 in part); *Tamonea scabra*, Cham. & Schlecht. (110); *Priva echinata*, Juss. (148); *Bouchea Ehrenbergii*, Cham., a stout form (280), and a variety with laciniate-toothed leaves (102); *Stachytarpha dichotoma*, Vahl (150); *Petrea arborea*, H. B. K., but it is scandent, "ascending to the tops of the highest trees" (342); *Verbena Aubletia*, L. (236), and *V. Ehrenbergiana*, Schauer? (153).

The Labiatæ are *Ocimum micranthum*, Willd. (117, 252); *Hyptis capitata*, Jacq. (309); *H. suaveolens*, Poit. (108); *H. spicata*, Poit. (118); *H. spicigera*, Lam., to which belongs Anderson's *H. subverticillata*, from the Galapagos (116); *Micromeria Xalapensis*, Benth. (106); *Hedeoma Drummondi*, Benth. (141, 366), and *Scutellaria microphylla*, Moç. & Sesse? (242).

The Borraginaceæ are *Cordia ferruginea*, Rœm. & Schult. (170); *Heliotropium inundatum*, Sw. (165); *H. phyllostachyum*, Torr. Bot. Mex. Bound. p. 137, which is apparently *H. myosotoides* of Chapman's Flora S. U. S., and probably some old tropical species (129); *Heliophytum Indicum*, DC. (164) and *H. parviflorum*, DC. (163).

The Scrophulariaceæ are *Angelonia angustifolia*, Benth. (104); *Russelia sarmentosa*, Jacq. (223, 263), and *R. juncea*, Zucc. (115); *Stemodia parviflora*, Ait. (248); and *S. peduncularis*, Benth., which I suppose is also *S. Jorullensis*, H. B. K., and probably a variety of *S. trifoliolata*, with peduncles an inch or an inch and a half long (267); *Capraria biflora*, L. (184); *Pogostoma saxifragæfolia*, Schrad. (111); *Scoparia dulcis*, L. (253, 305); *Buchnera lithospermifolia*, H. B. K., too near *B. elongata* (117, 365); and *Lamourouxia cordata*, Cham. & Schlecht. (112).

The Solanaceæ are a single and poor specimen of *Solanum Jamesii*, Torr., perhaps *S. appendiculatum*, Dunal (175); Dunal's *S. torvum*, var. *ochraceo-ferrugineum* (285); *S. verbascifolium*, L. (301); a single specimen of *S. scabrum*, Vahl.; *S. volubile*, Sw.? (270); *S. quadriflorum*, Mart. & Gal.? (126); *S. nudum*, H. B. K.? (352); some common *Physalis* (215); *Cestrum dumetorum*, Schlecht. (322); *Datura Stramonium*, L. (293); and *Nicotiana plumbaginifolia*, Viv. (262).

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* Dr. Torrey's *Lippia Berlandieri*, in Bot. Mex. Bound., as to the specimens of Wright, &c., is not the real one, but is *L. graveolens*.

The Polemoniaceæ, *Gilia incisa*, Benth., before known in Mexico as far south as Monterey (235, 250); *Læselia coccinea*, Don (381).

The Hydroleaceæ, *Hydrolea spinosa*, L. (128); *Nama Jamaicensis*, L. (189); and *Wigandia macrophylla*, Cham. & Schlecht. (155), the latter apparently a good species. In De Candolle's Prodromus, for "foliis plusquam pollicaribus," we should read "foliis plusquam 15-pollicaribus."

The Convolvulaceæ are *Calonyction speciosum*, Chois. (350); *Jacquemontia hirsuta*, Chois. (157^b); and *Evolvulus linifolius*, L. (169).

The Gentianaceæ, *Eustoma exaltatum*, Griseb. (259, 315); and *Erythræa Chilensis*, Willd.? (186, 265), doubtless the Mexican plant of Hartweg's collection, but probably not the Chilian; the collector notes the flowers of 265 as golden-yellow.

The Apocynaceæ are *Rauwolfia heterophylla*, R. & S., var. *puberula* (374); the smooth variety of *Thevetia Yccotli*, DC., but with the veins of the leaves nearly inconspicuous (327); an *Echites*? in flower only (240), and another species, an *Amblyanthera* of Müller Argov., apparently a new species, in foliage, calyx, and very torose slender fruit very much resembling *E. tenuicaulis* of Spruce from the Amazon (a variety of *Amblyanthera versicolor*, Müll. Argov.), but the leaves are pubescent beneath, and with a deeper basal sinus, the corolla only half as long, its tube fusiform, the throat above the constriction not wider than the body below, a squamula under each lobe of the calyx (217); also

Prestonia Mexicana, A. DC. (127). In addition to the flowering specimens, we have in the collection a pair of follicles of this species, which help to complete the generic character. They are quite different from those of *Hæmadictyon*, as described by Müller in the Flora Brasiliensis, but more like those of *H.*? *Mexicana*, as described by De Candolle from Moçino and Sesse's figure. They may be thus characterized: Folliculi oblongo-conici, 3-pollicares, basi fere pollicem lati, prurienti-hirsutissimi, pericarpio crasso. Semina oblonga, sursum attenuata, apice comosa, testa fere suberosa.

The common *Asclepias Curassavica*, L. (132), represents its order, along with a plant which must be *Sarcostemma elegans*, Decaisne. But the leaves are rather broadly cordate or oblong-cordate, and tipped with a conspicuous cusp, the lobes of the corolla minutely puberulent within (174).

But the most interesting plant of the collection, and for which I am now enabled to complete the character, is the

Cytinus Americanus (R. Br.): dioica; floribus arcte sessilibus ebracteolatis, masculis e bractea paullo remotis; perianthio profunde 8–9-fido patentissimo, æstivatione contorto-imbricata; columna et stylo modice elongatis; cuspide connectivi antheris æquilonga; placentis 14–16 integris? (101). These specimens are very interesting, both as furnishing the female flowers and the habitat of this plant, both before unknown. They were collected by Mr. Ervendberg at Wartenberg, in wet places in the woods. The male plant from Mr. Barclay, which Mr. Brown examined, was in all probability also Mexican. As to the male flowers, the only thing of any importance to add to Mr. Brown's brief account is, that they are supra-axillary, being at a small distance above their subtending bracts. These bracts appear to be much more thick and coriaceous (as also is the perianth) than in *C. Hypocystis*. The flowers also are larger, and the perianth more deeply cleft. The latter when fully developed is half in inch long, and rotately campanulate; in æstivation only one lobe is exterior and one interior, the others overlapping one another in the convolute manner. The stamineal column becomes a line and half long, rather longer than the anthers. These are from 8 to 10 in number; their fleshy connective in some blossoms appear to be as much combined as in *C. Hypocystis*, while in others, probably older ones, they are less combined above, as Brown describes them, and radiate-spreading. The cusp terminating the connective is fleshy, and of the same nature as that of the other species, but is prolonged and subulate, usually as long as the anther itself. The female flowers collected are in an advanced state. The globose and very closely sessile gravid ovary is close to the subtending bract; the style between 1½ and 2 lines in length; the stigma radiate, but obscurely lobed. A cross-section of the gravid and enlarged ovary shows from 10 to 14 thin lamellar placentæ projecting far into the cell, and three to five smaller ones, only slightly projecting, all apparently simple (not lobed), and not approximate in pairs, covered with linear-oblong ovules; and moreover the parieties between the placentæ are ovuliferous as (apparently) Hooker figures them in *C. dioicus*. No one can examine the flowers without being struck (as were Linnæus, Jussieu, and Brown) with their affinity to Aristolochiaceæ.

The common *Boerhaavia erecta*, L. (156), and *Pisonia aculeata*, L.? the species uncertain for want of fruit (331), represent the Nyctagineæ; and *Coccoloba Humboldtii*, Meisn. (364) the Polygonaceæ.

The Phytolaccaceæ are *Rivina lævis*, var. *pubescens*, Griseb., the *R.*

humilis, L. (142, 302, 339), and the interesting *Agdestis clematidea*, Moç. & Sesse (146), of which Berlandier's no. 2367 is the female plant, in fruit. Concerning this genus, see Grisebach, Erlaut. Pl. Amer. Trop. p. 4.

Anredera scandens, Moq. (227), and the following Amarantaceæ (all common weeds, except the first), *Telanthera gracilis*, Moq. (287); *Alternanthera Achyrantha*, R. Br. (179); *Iresine celosioides*, L. (221); *Gomphrena globosa*, L. (140); *Cyathula achyranthoides*, Moq. (254); *Achyranthes aspera*, L. (359); *Chamissoa altissima*, H. B. K.; *Amarantus paniculatus*, L. (283).

The single Laurineous plant in the collection is an interesting and little-known one, viz. *Misanteca capitata*, Schlecht., with flowers and fruit. It well accords with the published description, except that the cupule of the fruit (which is said to be red, and is probably somewhat fleshy when fresh) is not sulcate, and its border is evenly truncate. The fruit itself seems to be a nut rather than a berry, as may also be inferred from the fact that the collector took the tree for an Oak. It is "a tall tree" (375).

The Euphorbiaceæ are *Acalypha alopecuroides*, Jacq. (304); an undetermined *Croton* (192), *C. Eleuteria*, L., or near it (199, 243), and the male of *C. trichocarpum*, Torr. Bot. Mex. Bound., p. 196 (167); *Dalechampia scandens*, L. (158^{a}), and another species allied to *D. convolvuloides* (348), an *Euphorbia* near to or identical with *E. hexagona*, Nutt. (157^{a}); *E. pilulifera*, L. (133); and *E. dioica*, H. B. K., which is *E. adenoptera*, Bertol., and, according to Dr. Engelmann, *E. anceps*, Benth., and *Anisophyllum densiflorum* of Klotzsch and Gärke, in their recent dissection of the natural Linnæan genus (251).

The Urticaceæ are *Pilea microphylla*, Liebm. (*P. muscosa*, Lindl., &c. 172); an undetermined *Ficus* (332); *Dorstenia Contrayerva*, L. (198), and *D. excentrica*, Moricand (123); the interesting *Castilloa elastica*, Cerv. (371); and a *Celtis* (nearly of the section *Mertensia*, H. B. K.) which appears to be new, but which I am unwilling now to describe as such (321).

There is a common *Callitriche* (143); an *Artanthe* (234); *Peperomia Berlandieri*, Miq. (358); a *Salix* (178); *Myrica Xalapensis*, H. B. K. (204); and a *Quercus*, the same as Berlandier's no. 2194 (346).

The Endogenæ of the collection are very few, consisting of the inflorescence of a "Palm, 30 or 40 feet high, with flabelliform leaves, used for covering roofs, and a sweet, edible fruit," apparently the same as Berlandier's 3207, probably *Sabal umbraculifera*, Mart. (314); two *Cannaceæ* (274, 282); *Bomarea hirtella*, Herb. (205); a *Tillandsia* (276) and a *Bromelia?* (372); *Pontederia sagittata*, Presl. (277); *Smilax mollis*, H. B. K. (325), *S. platycentra*, Schlecht.? but nearly unarmed (244, 336, 337), and another, perhaps the male of *S. glaucocarpa*, Schlecht. (363); a *Tradescantia* (275); *Eleocharis geniculata*, L. (208); *Panicum divaricatum*, L. (281) and *P. hirtellum*, L. (266).

The Ferns, separately numbered, are, *Polypodium incanum*, Sw. (8), *P. repens*, Sw. (16), *P. decumanum*, Willd. (15), and *P. lycopodioides*, L. (9); *Gymnogramme* (*Hemionitis*) *palmata*, L. (6); *Cheilanthes elongata*, Willd. (19); *Adiantum Chilense*, var. *hirsutum*, Hook. (11), and *A. tenerum*, Sw. (17); a variety of *Pteris aquilina*, L., nearly *P. caudata* (4), and *P. grandifolia*, L. (5); *Asplenium pumilum*, Sw. (10); *Phegopteris tetragona*, Mettenius (2, 13, 14); *Aspidium trifoliatum*, Sw. (1); *Anemia adiantifolia*, Sw. (3); and *Lygodium Mexicanum*, Presl. (7).

5. *Note on the Genus Graphephorum*, Desv., *and its Synonymy*. By Asa Gray.

This communication announced the discovery by Dr. Charles Pickering, in August last, at the Falls of the Riviere du Loup, in Lower Canada, of the "*Aira melicoides*" of Michaux, on which Desvaux and Beauvois founded the genus *Graphephorum;* also that the *Dupontia Cooleyi*, of the second edition of Gray's Manual of the Botany of the Northern United States, proves to be a large variety of the same species. Carrying out the view indicated in the Manual, Dr. Gray proposes to dispose the genus — so extended as to include *Dupontia*, R. Br., *Scolochloa* of Link, and *Arctophila* of Ruprecht — as follows: —

Genus GRAPHEPHORUM, Desv., Beauv.

Graphephorum, "Desv.," Beauv. Agrost. p. 76, t. 15, f. 8 (1812); "Desv. Jour. Bot. ann. 1813, p. 71"; Kunth, Enum. 1, p. 250, & Suppl. p. 193, t. 14, f. 9 (pistillum et squamulæ) = *G. melicoides*, Desv. (*Aira melicoides*, Michx.).

Dupontia, R. Br. App. Voy. Parry, p. 190 (1824) = *D. Fischeri*, R. Br.

Scolochloa, Link, Hort. Berol. Descr. 1, p. 136 (1827) = *S. festucacea*, Link (*Arundo festucacea*, Willd. *Festuca borealis*, Mert. & Koch. *F. arundinacea*, Lilijeb).

Dupontia et *Arctophila* (sub *Poa*), Rupr. Fl. Samoj. (in Beitr. Pflanz. Russ. Reiches, 2), p. 62, 64, t. 6 (1845) = Spp. plur.

Fluminia, Fries, Summ. Veg. Scand. 1, p. 247 (1845 s. 1846) = *F. arundinacea*, Fries, seu *Festuca borealis*, Mert. & Koch.

Scolochloa (Link), *Dupontia* (R. Br.), et *Colpodium* § *Arctophila* (*C. fulvum* et *C. pendulinum*), Griseb. in Ledeb. Fl. Ross. 4, pp. 385, 386, 393 (1853).

§ 1. Paleæ firmiores, inferior nervis 7 prominulis: glumæ flores 3 – 4 æquantes. — SCOLOCHLOA.

1. G. FESTUCACEUM. *Arundo festucacea*, Willd. *Festuca borealis*, Mert. & Koch.; Hook. Fl. Bor. Am. 2, t. 231. *Scolochloa festucacea*, Link, Griseb. *Fluminia arundinacea*, Fries.

§ 2. Rhachis spiculæ etiam barbata; glumæ scabræ, inæquales, flores 3 – 4 subæquantes. — GRAPHEPHORUM, Desv.

2. G. MELICOIDES, Beauv. l. c. *Aira melicoides*, Michx.

Var. MAJOR. *Dupontia Cooleyi*, Gray, Man. Bot. N. U. S. ed. 2, p. 556. (Caryopsis libera!)

§ 3. Paleæ tenuiores; glumæ flores 2 – 3 subæquantes. — DUPONTIA.

3. G. FISCHERI. *Dupontia Fischeri*, R. Br. *Poa* (*Dupontia*) *pelligera*, Rupr. l. c. ✓

✓Var. PSILOSANTHUM. *Poa* (*Dupontia*) *psilosantha*, Rupr. l. c. *Dupontia psilosantha*, Rupr. l. c. t. 6; Griseb. l. c.

§ 4. Glumæ spicula 2 – 7-flora breviores; flores parvuli. — ARCTOPHILA.

4. G. FULVUM. *Poa fulva*, Trin. *Poa* (*Arctophila*) *fulva*, *scleroclada*, *latiflora*, & *pœcilantha*, Rupr. ex Griseb. *Glyceria fulva*, Fries. *Colpodium* (*Arctophila*) *fulvum*, Griseb.

5. G. PENDULINUM. *Poa pendulina*, Fl. Dan. t. 2343. *Poa* (*Arctophila*) *deflexa*, *remotiflora*, & *similis*, Rupr. *Glyceria pendulina*, Lœstad. *Colpodium* (*Arctophila*) *pendulinum*, Griseb.

Four hundred and ninety-second meeting.

February 4, 1861. — MONTHLY MEETING.

The PRESIDENT in the chair.

In accordance with the vote passed at the last preceding monthly meeting (*vide* p. 112), the Academy convened at the house of the venerable Josiah Quincy, upon the occasion of his entering his ninetieth year. The Academy by its President offered an appropriate address to Mr. Quincy, who responded in some interesting remarks, and the Academy was addressed upon the occasion by the President of Harvard University, the Hon. James Savage, and Professor W. B. Rogers.

Four hundred and ninety-third meeting.

March 12, 1861. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Horsford exhibited excellent drawings, by Mr. Hand, of New York, of magnified dissections and preparations of the grain of wheat, especially of the coats and superficial portion or *bran*, which has been long since ascertained to contain the principal part of the gluten, this indicating the importance of retaining as much of the bran in the bread as possible.

Professor C. W. Eliot read the following paper: —

On the Chromate of Chromium, and analogous Chromates, with a New View of the Constitution of the Black Oxide of Manganese. By FRANK H. STORER and CHARLES W. ELIOT.

I. CHROMATE OF CHROMIUM ($Cr_2O_3\ CrO_3$).

1. When a solution of monochromate of potash is mixed with a solution of any ter-salt of chromic oxide, the mixture immediately becomes brownish red, a bright brown precipitate subsides, and when this precipitate has been completely deposited, the liquid separated by filtration will present the clear yellowish-red color of bichromate of potash. The chrome salt may be chrome alum, or sulphate of chromic oxide, or hydrated sesquichloride of chromium, and, if a sufficient excess of chromate of potash be added to the solution, the precipitate and the filtrate will present the appearances described. This filtrate may be evaporated and crystallized; the resulting crystals will be a mixture of bichromate of potash and of sulphate of potash or chloride of potassium, as the case may be: often crystals of monochromate of potash will also present themselves. We prepared the precipitate for analysis by mixing a solution of chrome alum with an excess of monochromate of potash. The brown precipitate was washed with cold water: the color of the wash-water, at first bright yellow, became gradually paler, but never colorless. Twice in the course of the seven days during which the washing was continued, the precipitate was transferred from the filter to a mortar, stirred up with water, and thrown upon a fresh filter. This pro-

cess deepened the yellow color of the wash-water in each case. It being quite evident that the color of the wash-water was due to chromic acid abstracted from the precipitate, the washing was stopped on the eighth day, the precipitate was dried at 50° to 55°, and analyzed as follows. A portion was dissolved in very dilute nitric acid by the aid of a gentle heat; the color of the solution was a red brown. Ammonia, added in very slight excess to this solution, kept at the boiling point for half an hour, produced a brownish-green precipitate of chromic oxide, which looked the browner because it floated in a bright yellow liquid. This precipitate was filtered off and thoroughly washed with hot water; it then presented the common appearance of chromic oxide, and was ignited and weighed in the usual manner. The filtrate from this precipitate and the wash-waters were concentrated by evaporation, and acidified with acetic acid. Acetate of lead then precipitated the whole of the chromic acid contained in the yellow liquid, and after the subsidence of the precipitate the supernatant liquid was perfectly colorless. The chromate of lead was washed and weighed on a tared filter as usual. The result of the analysis was

CrO_3 = 16.27 per cent
Cr_2O_3 = 46.43 " "
Water = 37.30 " " (by difference).

This examination showed, first, that the washed precipitate was a compound of chromic acid and chromic oxide; secondly, that it was more basic than any supposable definite compound of these two bodies; thirdly, that the prolonged washing removed chromic acid from the substance originally precipitated. To study the effect of the washing upon the precipitate, we prepared a considerable quantity of the brown precipitate by mixing a concentrated solution of pure chrome alum with a large excess of a concentrated solution of monochromate of potash. The precipitate as first collected upon the filter of course retained a considerable quantity of the bichromate of potash, chromate of potash, and sulphate of potash which existed in the filtrate. The precipitate was quickly rinsed with cold water until these mechanically adhering salts seemed to have been removed. During this short washing the substance underwent no change in color or in any other external property. A portion was now removed from the filter, air-dried on a brick, and submitted to analysis (analysis *a*). The rest of the precipitate was washed for six hours with cold water; another portion was then taken from the filter, air-dried, and analyzed (analysis *b*). Through the remainder (perhaps two teaspoonfuls) of the precipitate five litres of water were passed; another portion was then dried at 100° and analyzed (analysis *c*). When dried at 100° the precipitate is much less readily soluble in dilute nitric acid, than when not so heated, but the difficulty is easily overcome. The method of analysis was that described above.

Analyses.

	a.	*b.*	*c.*
Cr_2O_3	39.69 per cent.	45.26 per cent.	65.17 per cent.
CrO_3	22.42 " "	15.12 " "	8.87 " "
HO (by diff.)	37.89 " "	39.62 " "	25.96 " "

A comparison of these three determinations teaches that the abstraction of chromic acid by washing with cold water stops at no definite point, and probably has no limit except the complete change of the original precipitate into chromic oxide. The composition of the substance *a* must be a close approximation to the composition of the original precipitate, for the slight rinsing which was intended merely to remove the chromates belonging to the filtrate could hardly have abstracted much of its combined chromic acid. In the chromate of chromium whose formula would be Cr_2O_3 CrO_3, the ratio of the chromic oxide to the chromic acid would be that of 3 : 2; and we find that the ratio of the chromic oxide to the chromic acid in analysis *a* is but little larger than that of 3 : 2. The substance *a* is probably therefore a chromate of chromium of the formula Cr_2O_3 CrO_3, from which a little of the chromic acid has been removed by washing.

Assuming for the present that the precipitate produced by the reaction of chrome alum on monochromate of potash is in truth this chromate of chromium, let us inquire into the nature of the reaction between these two salts by which this precipitate could be formed, and bichromate of potash left in the filtrate. Concentrated solutions of pure chrome alum and of pure monochromate of potash were prepared of known strengths, in order to determine the amount of either solution required to produce a precipitate in the other. A single drop of chrome alum solution produces an immediate and permanent precipitate in the chromate solution; but if the process be reversed and the solution of monochromate of potash be dropped into the alum solution, no permanent precipitate is formed till an apparently large excess of chromate of potash has been added. By accurate quantitative experiments we have proved that five equivalents of chromate of potash must be added to one equivalent of chrome alum to effect precipitation. If a less quantity be added, any precipitate which may form will at once redissolve when the mixture is made complete by agitation.* The reaction between the two salts may therefore be expressed by the formula,

$$5\,(\mathrm{KO\,CrO_3}) + \mathrm{KO\,SO_3,\ Cr_2O_3\ 3\,SO_3} = 4\,(\mathrm{KO\,SO_3}) + 2\,(\mathrm{KO\ 2\,CrO_3}) + \mathrm{Cr_2O_3\,CrO_3},$$

and if to one equivalent of chrome alum more than five equivalents of chromate of potash be added, the excess above five remains inactive.

$$x\,(\mathrm{KO\,CrO_3}) + \mathrm{KO\,SO_3,\ Cr_2O_3\ 3\,SO_3} = 4\,(\mathrm{KO\,SO_3}) + 2\,(\mathrm{KO\ 2\,CrO_3}) + \mathrm{Cr_2O_3\,CrO_3} + (x - 5)\ (\mathrm{KO\,CrO_3}).$$

If any other normal salt of chromic oxide be used, a similar formula will express the reaction; thus:—

$$\mathrm{Cr_2Cl_3} + 5\,(\mathrm{KO\,CrO_3}) = 3\,(\mathrm{K\,Cl}) + 2\,(\mathrm{KO\ 2\,CrO_3}) + \mathrm{Cr_2O_3\,CrO_3}.$$

$$\mathrm{Cr_2O_3\ 3\,SO_3} + 5\,(\mathrm{KO\,CrO_3}) = 3\,(\mathrm{KO\,SO_3}) + 2\,(\mathrm{KO\ 2\,CrO_3}) + \mathrm{Cr_2O_3\,CrO_3}.$$

With the exact proportions of chrome alum and chromate of potash which are by the formula necessary for the precipitation of chromate of chromium we prepared a quantity of the precipitate for a second series of analyses in corroboration of analyses *a*, *b*, and *c*. The precipitate thrown upon a filter was very slightly rinsed with cold water, a portion of it was taken off, pressed between folds of filter-paper under heavy weights, and air-dried for analysis (analysis *d*); the rest of the precipitate was washed for six hours till no trace of the filtrate could possibly be supposed to be retained by the precipitate, when another portion was taken out for analysis, pressed, and air-dried (analysis *e*); lastly five litres of water were passed through the remaining precipitate, which was then dried at 100° and submitted to analysis (analysis *f*). The process of analysis was the same described above, and the results were as follows: —

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* In this connection we would call attention to the inaccuracy of the statement made by Berzelius in his *Traité de Chimie*, (Paris, 1846, Vol. II. 307), to the effect that a compound whose formula is $\mathrm{Cr_2O_3\ 3\,CrO_3}$ is precipitated, when a few drops of the solution of monochromate of potash are added to the solution of a neutral chrome salt. No permanent precipitate whatever is produced under these circumstances, as any one may satisfy himself by repeating the simple experiment described above.

Analyses.

	d.	*e.*	*f.*
Cr_2O_3	38.85 per cent.	44.01 per cent.	59.83 per cent.
CrO_3	25.91 " "	19.88 " "	13.43 " "
HO (by diff.)	35.24 " "	36.11 " "	26.74 " "

This set of analyses corroborates the first series in every respect, and the ratio of the chromic oxide to the chromic acid of the substance *d* is almost precisely the ratio 3 : 2 of the chromic oxide to the chromic acid in the chromate of chromium Cr_2O_3 CrO_3. We again see that there is no definite limit to the removal of chromic acid by prolonged washing, and that the substance may be readily made more basic than any imaginable definite compound of chromic oxide and chromic acid would be.

In these analyses the precipitates had been somewhat washed before any analysis was made; it remained to analyze the substance precipitated with so much of the adhering filtrate as could not be removed by pressure between folds of filter-paper without washing. One precipitate (analysis *g*) was prepared by mixing a solution of one equivalent of chrome alum with eight equivalents of chromate of potash in solution, and a second by mixing a solution of one equivalent of chrome alum with sixteen equivalents of chromate of potash in solution (analysis *h*). In both cases the solutions used were concentrated and the precipitates air-dried. The method of analysis which we had heretofore employed was open to one objection, — a trace of chromic oxide was liable to be dissolved in the excess of ammonia, to be again separated when the filtrate and wash-waters from the chromic oxide precipitate were concentrated by evaporation, and the process would obviously be altogether inadmissible in any case where the sulphates of the mother-liquor had not been removed by washing before submitting the precipitate to analysis, since sulphate of lead would be formed and vitiate the determination of the chromic acid. We therefore resorted to Rose's method of separating chromic oxide from chromic acid, by means of the nitrate of the suboxide of mercury.* The solution of the substance to be analyzed in dilute nitric acid was nearly neutralized with carbonate of potash, and when the carbonic acid had been allowed sufficient time to escape, nitrate of the suboxide of mercury was added, the precipitate filtered off, washed, strongly ignited, and the chromic acid calculated from the pure chromic oxide which remained. To the filtrate from this first precipitate ammonia in excess was added, and the washed precipitate, strongly ignited, was the chromic oxide contained in the original substance.

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* Handbuch der Analytischen Chemie, (Braunschweig, 1851,) II. 379.

Analyses.

	g.	*h.*
Cr_2O_3	33.06 per cent.	33.54 per cent.
CrO_3	32.03 "	30.53 " "
HO (by difference)	34.91 " "	35.93 " "

It is quite evident from these analyses that the precipitate caused by mixing chromate of potash with a neutral chrome salt cannot contain more than one equivalent of chromic acid in combination with its chromic oxide, since in the above determinations the chromic acid is nearer one equivalent than two with reference to the chromic oxide found, in spite of the fact that the considerable amount of chromic acid which, combined with potash, has adhered mechanically to the precipitate, is thrown down by the nitrate of the suboxide of mercury, together with the chromic acid which was originally united to the chromic oxide. But the fact that the substance under examination cannot be purified by washing without altering its constitution, renders it impossible to ascertain the exact composition of the body by the methods of analysis heretofore used, or by any similar methods; for this purpose the process used by Vogel* in analyzing this same substance, obtained by him from a different source and miscalled CrO_2, is admirably adapted. The precipitate examined by this method was not washed at all, but was simply dried by pressure between folds of filter-paper and exposure to the air. A weighed portion was placed in the bulb of a reduction-tube, with which a weighed chloride of calcium tube was connected; a current of dry air was then drawn through the apparatus, and the reduction-tube was cautiously heated till all the water of the precipitate had been absorbed by the weighed chloride of calcium tube, the heat finally rising to dull redness. The salts with which the precipitate under examination was contaminated were sulphate of potash, bichromate of potash, and a little chromate of potash, and since the solutions from which the precipitate was prepared were concentrated, it was to be expected that a considerable quantity of these salts would adhere to the precipitate; but since all these salts are fixed at a low red heat, they were not altered by the heat to which the precipitate was exposed. The rest of the precipitate must have lost by the ignition all its water and all the oxygen over and above that necessary to the constitution of chromic oxide. By subtracting the weight of the water collected from the total loss by ignition, the weight of the oxygen expelled is obtained. The ignited residue was then washed out of the bulb of the reduction-tube, digested in hot water, thrown upon a filter and washed with hot water till only pure chromic oxide remained; lastly, this oxide was ignited and weighed. By subtracting the weight of the chromic oxide from the weight of the whole ignited residue, the weight of the soluble salts which adhered mechanically to the precipitate was obtained. The following are the figures of an analysis by this method: —

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* Jour. pr. Ch., LXXVII. 484 (1859).

Weight of reduction-tube + precipitate	10.3848	gram.
" " "	9.6136	"
" " precipitate	0.7712	"
Weight of reduction-tube after ignition	10.2673	"
Loss by ignition	0.1175	"
Weight of residue	0.6537	"
Weight of CaCl tube after ignition	17.4196	"
" " " " before "	17.3204	"
" " water	0.0992	"
" " oxygen = .1175 — .0992 =	0.0183	"
Weight of crucible + Cr_2O_3	13.1275	"
" " " + filter ash	12.9601	"
" " Cr_2O_3	0.1674	"
" " soluble salts = .6537 — .1674 =	0.4863	"

In the compound whose formula is $Cr_2O_3\ CrO_3$, the ratio of the number of atoms of oxygen to the number of atoms of chromium is that of 2 : 1. By adding another equivalent of oxygen to the chromic oxide found, we shall make the ratio of the atoms of oxygen to the atoms of chromium that of the compound $Cr_2O_3\ CrO_3$. Hence the proportion.

$$\begin{array}{ccccccc} (\text{Equiv. } Cr_2O_3) & & (\text{Equiv. O}) & = & (Cr_2O_3 \text{ found}) & & (1 \text{ equiv. O}) \\ 76.48 & : & 8 & = & 0.1674 & : & x = 0.0175 \end{array}$$

If the original precipitate was the compound whose formula is $Cr_2O_3\ CrO_3$, the loss of oxygen by ignition would have been 0.0175 gram.; the actual loss was 0.0183 gram., being within 0.0008 gram. of the theoretical amount. A loss of eight tenths of a milligramme in the water determination would of course account for this very small excess of oxygen.

A second analysis by this method of a precipitate containing a smaller proportion of soluble salts corroborated the first determination in every respect, and left no doubt that the true composition of the precipitate produced in the aqueous solution of a neutral salt of chromic oxide by the solution of chromate of potash is represented by the formula $Cr_2O_3\ CrO_3$.

2. Schweitzer* observed that, when nitric oxide is passed through a moderately dilute solution of bichromate of potash, a brown precipitate separates after some time, especially if the liquid be slightly warmed. He did not analyze the substance, but remarks that it presents all the appearance of the brown oxide of chromium (so called). We prepared this compound by passing a stream of nitric oxide through a very dilute solution of bichromate of potash (a strong solution will not give the reaction so readily, if, indeed, at all) for three hours; in a few minutes the liquid became dark-colored and ceased to be transparent, but after standing twenty-four hours, during four of which it had been gently heated, there was still no apparent deposit; it was again warmed, and after sixteen hours more a slimy red-brown deposit was found at the bottom of the vessel. During forty-eight hours longer this deposit was allowed to accumulate, when the supernatant liquid was decanted and the precipitate thrown upon a filter. The decanted fluid continued to deposit very slowly this red-brown matter for days and weeks; indeed, in this, and several similar experiments, we have found no limit of time to the continuous, though very gradual, accumulation of this deposit. The slimy precipitate which had been filtered off was washed with hot water for twelve hours, the water at first coming through of a dark-red color, but growing gradually paler till it retained only a feeble yellow. The washing was continued for a week with cold water, and more than nine litres of water passed through the small precipitate. Whenever the color of the wash-water became so

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* Jour. Pr. Ch., XXXIX. 269 (1846).

pale as to be hardly perceptible except with a considerable thickness of liquid, it was only necessary to transfer the precipitate to a mortar, rub it with water and throw it upon a fresh filter, in order greatly to intensify the yellow color of the filtrate. Believing that the chromic acid which colored the wash-water was derived from the decomposition of the precipitate, we stopped the washing on the eighth day, dried the precipitate at 50° – 55°, and analyzed it by the first method described above. The color of the solution of the substance in dilute nitric acid was red-brown, and of the precipitate produced by ammonia, dirty green, which washing changed to the usual color of chromic oxide. The result of the analysis was, —

Cr_2O_3 = 53.31 per cent.
CrO_3 = 18.64 " "
HO (by difference) = 28.05 " "

In regard to the ratio of the chromic oxide to the chromic acid, this result is very much like that of the first analysis given above (page 193), and leads to the same conclusions, viz. that the original precipitate is a compound of chromic oxide and chromic acid, from which prolonged washing abstracts chromic acid to an indefinite extent. We next prepared a new precipitate by passing nitric oxide through a dilute solution of bichromate of potash, and, without washing it at all, pressed it between folds of filter-paper, dried it by exposure to the air, and analyzed it by Rose's method, above described, with the following result: —

Cr_2O_3 = 28.55 per cent.
CrO_3 = 29.33 " "
HO (by difference) = 42.12 " "

The object of this analysis was to prove that, even when the precipitate was contaminated with the chromates of the filtrate, the proportion of the chromic acid to the chromic oxide fell far below that which would exist in a compound containing two equivalents of chromic acid to one of chromic oxide, thus making it probable that the true formula of the precipitate is $Cr_2O_3\ CrO_3$.

To determine the exact proportions of chromic oxide and chromic acid in the original substance evidently requires a different process of analysis, and the third method of analysis described above is applicable to this purpose, with this advantage over the case to which we first applied it, that the precipitate separates from such a dilute solution as to carry but a small proportion of soluble salts into the wholly unwashed deposit. The following are the figures of such an analysis of the precipitate pressed between folds of filter-paper without washing, and air-dried.

Weight of the reduction-tube + precipitate	9.1856	gram.
“ “ “	8.5520	“
“ “ precipitate	0.6336	“
“ “ reduction-tube after ignition	8.9342	“
Loss by ignition	0.2514	“
Weight of residue	0.3822	“
Weight of CaCl tube after ignition	17.6352	“
“ “ “ before “	17.4210	“
“ “ water	0.2142	“
“ “ oxygen = .2514 — .2142	.0372	“
Weight of crucible + Cr_2O_3	35.0227	“
“ “ “ + filter ash	34.7345	“
“ “ Cr_2O_3	.2882	“
“ “ soluble salts = .3822 — .2882 =	.0940	“

(Equiv. Cr_2O_3) : (Equiv. O) = (Cr_2O_3 found) : (1 equiv. O).

The proportion $76.48 : 8 = .2882 : x = .0302$ gives the theoretical amount of oxygen necessary to bring the chromic oxide found up to the composition expressed by the formula $Cr_2O_3\ CrO_3$ at 0.0302 gram.; the oxygen actually found was 0.0372 gram., being seven milligrammes in excess of the theoretical amount. When it is remembered that the unavoidable loss in the water determination, however small, tends to increase the amount of oxygen found, and that the loss in the chromic oxide determination tends to decrease the theoretical amount of oxygen, a discrepancy of only seven milligrammes will be considered allowable. A second analysis of the same precipitate by the same method gave even a nearer result, viz.: —

Oxygen required to raise the Cr_2O_3 found to the composition $Cr_2O_3\ CrO_3$	0.0235	gram.
Oxygen actually found	0.0264	“

These two analyses, in connection with the preceding determinations by the other methods, seem to us to prove conclusively that the precipitate produced by passing nitric oxide through a solution of bichromate of potash is a chromate of chromic oxide, having the formula Cr_2O_3 CrO_3. Schweitzer expressed his conception of the reaction by the formula

$$4\,(KO\,2\,CrO_3) + 2\,NO_2 = 2\,(KO\,CrO_3) + 2\,(KO\,NO_5) + 6\,(CrO_2);$$

we shall write it, in accordance with the results of our analyses,

$$2\,(KO\,2\,CrO_3) + NO_2 = KO\,NO_5 + KO\,CrO_3 + Cr_2O_3\,CrO_3.$$

3. The same partial reduction of the chromic acid in bichromate of potash, which in the reaction just described is effected by nitric oxide, may be accomplished by alcohol with the aid of light. The precipitate so produced has been analyzed by Vogel,* who assigns to it the composition which would be expressed by the formula Cr_2O_3 CrO_3, though, for reasons hereafter to be considered, he seems to prefer the formula CrO_2. The precipitate thus obtained by alcohol† is identical in color and texture with that produced by nitric oxide, or by the double reaction between a neutral salt of chromic oxide and monochromate of potash. It is unnecessary in this connection to refer to the well-known reduction of aqueous chromic acid by sulphurous acid, by certain organic acids, by alcohol, and by paper; light and heat facilitate the reduction, and the brown chromate of chromic oxide is often produced when the reduction is but partial.‡

4. Again, the chromate of chromic oxide may be obtained by the oxidation of the hydrate of chromic oxide. When pure hydrated chromic oxide is treated with chlorine water, the oxide is converted into the brown chromate of chromic oxide, provided that the quantity of chlorine water be not sufficient to effect the solution of the chromate of chromic oxide formed in the chlorhydric acid which results from the reaction. Of course, the chromate of chromic oxide cannot be pre-

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* Jour. pr. Ch., LXXVII. 482, (1859,) and Dingler's Polyt. J., CLIII. 391.

† We desire to correct a serious misprint in Vogel's note, as given in the Journal für praktische Chemie (LXXVII. 482), and thence transferred into Kopp & Will's Jahresbericht für 1859, p. 171. In the second line of the Article, "Ammoniak" should be "Alkohol." We trust this correction may save others the trouble we took before it occurred to us that the error was a typographical one, in endeavoring to verify or account for the marvellous statement that bichromate of potash was reduced by ammonia. The word is correctly printed in the abridgment of the same article given in Dingler's Journal, CLIII. 391.

‡ Gmelin's Handbook (Cavendish Soc. Ed.), IV. 119.

pared for analysis in this way, because a mixture of substances is the result to be expected from the incomplete reaction. Again, the partial oxidation of hydrated chromic oxide may be effected by exposing it for a long time to a temperature above 200°, but below redness, with free access of air.*

The most precise statement on this subject has been made by Krüger,† whose main purpose was to prove that the glowing of ignited chromic oxide was due to the sudden escape of oxygen absorbed at a lower temperature, but who incidentally maintains that this absorption of oxygen gives rise to a definite oxide of chromium whose formula is CrO_2. We think to be able to show, first, that no definite compound whatever is formed during this imperfect oxidation; secondly, that the substance which really results from the prolonged heating contains chromic acid, and is an indeterminate approximation to the body whose formula is $Cr_2O_3\ CrO_3$. It is obviously impossible to expose all parts of a substance in powder, like the hydrated chromic oxide, to the uniform action of the same quantity of air at the same temperature for the same time, and the limits of temperature between which the desired absorption of oxygen will take place most readily are not very clearly defined. Under these circumstances we should expect to obtain, not a definite compound, but a mixture, and the figures of Krüger's own analysis fully confirm this expectation. Krüger found 63.70 per cent of chromium and 36.30 per cent of oxygen in the body which he analyzed; the supposed oxide of chromium, CrO_2, would contain 62.12 per cent of chromium, giving a discrepancy of 1.58 per cent between the chromium of Krüger's substance and the chromium of the imaginary CrO_2. This does not seem an inadmissible error, till we observe that the whole difference between the chromium in chromic oxide (68.62 per cent) with which Krüger began, and the chromium in the supposed higher oxide CrO_2 (62.12 per cent), is only 6.50 per cent, and that his error of 1.58 per cent in the amount of chromium is therefore nearly twenty-five per cent of the whole difference between the bodies Cr_2O_3 and CrO_2. With so fatal a discrepancy between the actual and the theoretical figures, it is of course impossible to maintain that a definite oxide is obtained by such an indefinite process. We pass to the second point, the existence of chromic acid in imperfectly oxidized chromic oxide. Krüger thought to disprove the presence of chromic acid by heating the substance with sulphuric acid and common salt; no chromate of chloride of chromium being visible, he inferred the absence of chromic acid. This test is at best but an unsatisfactory one when applied to a very insoluble substance containing only a small proportion of chromic acid, and there seems to be no reason for trusting to a coarse reaction in a difficult case when very delicate tests are at hand. By heating hydrated chromic oxide for five hours to a temperature varying between 200° and 210° we obtained a brownish black powder, which dissolved with great difficulty in dilute acids, communicating a dark yellow color to the liquid. Digested with water, the powder yielded a partial solution of a bright yellow color, and this solution gave a very marked reaction for perchromic acid with the solution of peroxide of hydrogen.* When quickly boiled with an aqueous solution of chloride of ammonium, the filtered solution was bright yellow, and gave the reaction of perchromic acid with peroxide of hydrogen. Would it not be difficult to explain this effect of aqueous chloride of ammonium on the brown powder on the supposition that its real composition was represented by the formula CrO_2? Krüger endeavored to strengthen his position with regard to the absence of chromic acid, by heating with common salt and sulphuric acid a precipitate prepared by mixing bichromate of potash, sulphate of chromic oxide, and ammonia, and finding as before no chromate of chloride of chromium; he used the precipitate in one experiment air-dried, in another, dried at 110°. This precipitate was probably a mixture of chromic oxide with the chromate of chromic oxide, and, unless the last ingredient was present in very small proportion, it should have readily produced chromate of chloride of chromium. From a portion of the precipitate used in analysis *f*, we obtained without difficulty the red chromate of chloride of chromium by heating it with chloride of sodium and strong sulphuric acid. We shall have occasion to cite below a similar experiment upon an anhydrous mixture of chromic oxide and chromic acid, obtained by gently igniting the nitrate of chromic oxide, in which the chromate of the chloride of chromium was very readily obtained. Relying on the yellow color imparted by the substance under examination to water and to chloride of ammonium, and on the ready exhibition of perchromic acid by means of peroxide of hydrogen, and explaining Krüger's failure to obtain chlorochromic acid by the fact that only a very small amount of chromic acid proportionally exists in the mixture, we conclude that, by long heating in the air, a part of the chromic oxide is converted into chromic acid, which instantly combines with other chromic oxide, and that the end of this process, seldom if ever attained, is the conversion of the whole mass into the chromate of chromic oxide, $Cr_2O_3\ CrO_3$.

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* The partial conversion of chromic oxide into chromic acid by gentle roasting seems to have been applied in the arts years ago. Cooley, in his Cyclopædia of Practical Receipts, (London, 1845, p. 263,) describes Charles Watt's process of preparing chromic acid from the oxide of chromium precipitated by lime from the residual liquor of the process of bleaching with chromic acid. The precipitate was heated evenly in a thin layer on a flat iron plate, with frequent stirring, till the mass assumed a yellow color. If too much heat was employed, the product of this operation was easily decomposed, assuming a green color. This process was apparently a true conversion of chromic oxide into chromic acid by roasting, and should not be confounded with the method of preparing chromate of lime described by Jacquelain (Ann. de Ch. et de Phys., [3.] XXI. 478), in which a mixture of lime and chrome-iron ore was heated to redness in a reverberatory furnace.

† Jour. pr. Ch., XXXII. 383, (1844,) and Pogg. Ann., LXI. pp. 219, 406.

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* Storer, Proc. Amer. Acad., IV. 138; Jour. pr. Ch., LXXX. 44.

5. Many chemists, among whom may be mentioned Vauquelin, Berzelius, Döbereiner, and Thomson, have tried the experiment of gently igniting the nitrate of chromic oxide, or, what amounts to the same thing, of evaporating to dryness nitric acid in contact with metallic chromium or hydrated chromic oxide, and moderately heating the residue. Some, like Berzelius,* have thought that they obtained in this way a definite oxide of chromium, intermediate between chromic oxide and chromic acid, and answering to the formula CrO_2; others, like Vauquelin,† have imagined that they obtained chromic acid by repeated evaporation of nitric acid with chromium, or have believed, with Thomson ‡ and Godon,§ that a great part of the green oxide was converted into chromic acid; while others still have maintained, with Döbereiner, ‖ that the chromate of chromic oxide was formed by the decomposition of the nitrate.

In order to a clear knowledge of the effect of evaporating nitric acid with chromic oxide, it is necessary in the first place to answer qualitatively the question, Is chromic acid formed during the process? A mixture of nitric acid and hydrated chromic oxide was gently evaporated, first on a water-bath, then upon a sand-bath, and before the free nitric acid was completely driven off, a portion of the moist mass was treated with a solution of caustic potash; it partially dissolved with a yellow color, and the solution gave the distinct blue of perchromic acid with peroxide of hydrogen. The rest of the evaporated residue was heated till it looked like a perfectly dry powder, but still retained the smell of nitric acid. In this condition a portion was treated with water, in which it slowly and partially dissolved, yielding a brownish yellow solution, which readily gave the blue of perchromic acid. A half of the remaining residue from the original evaporation was strongly heated in a porcelain dish on a sand-bath, and then digested with water during four hours; the solution so obtained was decidedly yellow, and gave easily the blue of perchromic acid. The other half of the residue was heated on platinum foil, till the platinum was of a dull red color in a darkened room, and was then soaked in water for thirty-six hours; the supernatant liquid was of a pale yellow color, and gave a faint blue with peroxide of hydrogen. The same substance treated with caustic potash gave a yellow solution.

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* Thomson's Ann. Phil., III. 104, (1814,) and Schweigger's J. für Ch. u. Phys., XXII. 56.

† Ann. de Chim., XXV. 201 (1798).

‡ Phil. Trans., 1827, Part I. p. 206.

§ Rapport par MM. Berthollet et Vauquelin, Ann. de Ch., LIII. 224.

‖ Schweigger's Jour. für Ch. u. Phys., XXII. 482 (1818).

With this qualitative evidence of the formation of an abundance of chromic acid at a moderate temperature, which is not wholly destroyed even at incipient redness, we proceeded to the quantitative determination of the amount of chromic acid formed at the different stages of the process. A quantity of pure hydrated chromic oxide was treated in a porcelain dish with an excess of pure nitric acid, and evaporated on a water-bath nearly to dryness; those parts of the substance which dried completely were moistened with nitric acid and again dried. The nitric acid could not be completely driven off on the water-bath; though the larger part of the mass seemed dry, yet portions of it were still moist when the process was stopped, and it was far from being homogeneous. The brownish black substance imparted a strong yellow tinge to water, and dissolved with difficulty in dilute nitric acid, giving a brownish yellow solution. A portion of it, analyzed by Rose's method, gave

$Cr_2O_3 = 64.85$ per cent.
$CrO_3 = 31.51$ "
NO_5 and $HO = 3.64$ " (by difference).

It was now necessary to prepare for analysis from the evaporated residue a series of homogeneous substances, each of which had been exposed to a little higher temperature than the preceding one, in order to exhibit the effect of different temperatures in the production of chromic acid. A portion (No. 1) of the evaporated residue was heated on a porcelain dish at a low temperature, with constant stirring, to complete dryness; a second portion (No. 2) was first thoroughly dried at the same temperature to which No. 1 had been exposed, and was then somewhat more strongly, but still very gently, heated for a few moments, during which nitrous fumes escaped in abundance; in this manner each substance was dried at the highest temperature to which the preceding one had been exposed, and was then subjected to a little stronger heat during five or ten minutes; the last substance (No. 5) was heated as hot as was possible, while avoiding incipient redness. The chromic acid of each substance was determined by precipitating it with nitrate of the suboxide of mercury; the chromic oxide was also determined in two or three cases, but only to control the analyses. All five substances were soaked in water for five hours; pure nitric acid was then added in very small quantity, and, at the end of forty-four hours more, solution had been effected in each case. The color of the dry powder was brownish black, that of the solutions brownish yellow. The percentage of chromic acid in each substance was as follows:—

	CrO_3.	
No. 1,	25.18	per cent.
No. 2,	26.09	"
No. 3,	48.52	"
No. 4,	55.49	"
No. 5,	60.39	"

It therefore appears that a variable amount of chromic oxide may be converted into chromic acid by evaporation with nitric acid, and that the quantity so changed increases with the increase of temperature till incipient redness is reached. If this mixture of chromic oxide, chromic acid, and nitric acid be exposed to a red heat, the nitric acid and the absorbed oxygen are driven off together, and nothing remains but insoluble chromic oxide. It is sufficiently clear from these results, that no definite compound can be formed during this evaporation of nitric acid in contact with chromic oxide; the result is simply an indeterminate mixture of chromic oxide and chromic acid. It may be remarked, in passing, that this mixture closely resembles in every external property the brownish black powder obtained by gently heating chromic oxide in contact with the air, a substance which, as we have seen, is also an indeterminate mixture of chromic oxide and chromic acid, containing, however, very much less chromic acid than the mixture just examined. Substance No. 5 of the preceding series, although anhydrous, yields chlorochromic acid with salt and sulphuric acid with the greatest facility, another indication that the true explanation of Krüger's not obtaining chlorochromic acid from his heated chromic oxide is to be found in the fact that it contains too small an amount of chromic acid to be exhibited by that somewhat coarse reaction.

6. Many distinguished chemists have observed the reactions and studied several of the substances which we have here described, and no treatment of the subject can be complete which does not embrace an abstract of their labors. We shall therefore relate as concisely as possible the history of the substance which has been variously called brown oxide of chromium, or chromate of chromic oxide, and review the discussion as to its composition which has heretofore been brought to no satisfactory conclusion.

Vauquelin,* the discoverer of chromium, obtained what he thought to be a brownish-red oxide of chromium by several methods, the details of which it is unnecessary to describe; it will be enough to observe, that neither of his methods gave him a definite compound; they all gave rise to indeterminate mixtures of the bodies now known as chromic oxide and chromic acid. He proved that nitric acid, whether cold or boiling, cannot oxidize chromic oxide, but that the calcination of the nitrate of chromic oxide produced a substance whose aqueous solution was red; ammonia precipitated from this solution the green oxide, and the separated filtrate was yellow. His experiments led Vauquelin to the conclusion, that there are two kinds of oxide of chromium, which differ only in the quantity of oxygen they contain.

Two errors, into which the reader of Vauquelin's papers might easily fall, demand notice. It might be inferred from some of his statements that the chromate of ammonia was a body readily decomposed by simple boiling with separation of the so-called brown oxide of chromium. We have found the chromate of ammonia to be a body possessing much greater stability than has been usually attributed to it; its aqueous solution will resist, without change, prolonged boiling, concentration, and exposure for weeks to the direct rays of the sun. It is true that repeated evaporation to dryness may partially decompose it, and it is of course destroyed by ignition.

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* Ann. de Ch., LXX. pp. 85, 86 (1809).

Again, Vauquelin asserts that ammonia will precipitate the brown oxide of chromium from an aqueous solution of chromic acid through which sulphurous acid has been passed, and this assertion seems to be confirmed by some statements, made without quoted authority in Gmelin's Handbook (Cavendish Soc. Ed., IV. 114), concerning salts of the brown oxide of chromium obtained by dissolving this hydrated oxide in acids, from which solutions it may be again precipitated by ammonia. This is an important point in determining the real existence of such an oxide of chromium, and we have therefore made it the subject of careful experiment. We have dissolved in dilute chlorhydric and dilute nitric acids such precipitates as analysis had shown to have very nearly the composition which is expressed by the formula CrO_2 (as, for instance, the precipitate of analysis *d*, and of the analysis on page 201), and have added to the solutions ammonia of every strength, from the strongest to the weakest, and have so obtained one invariable result, viz. a precipitate of common green chromic oxide, and a filtrate made yellow by chromate of ammonia. It is true that the fresh precipitate has a dirty or brownish look, caused by its impregnation with the yellow liquid in which it floats; and this is the most probable explanation of the opinion held by some previous observers, that this precipitate was something more than ordinary chromic oxide.

The chief authority upon which the existence of salts of the brown oxide of chromium is asserted, seems to be that of Brandenburg,* who obtained solutions of substances which his own experiments, rightly interpreted, prove to have been mixtures of chromic acid and salts of chromic oxide, but which he thought were salts of an imaginary higher oxide of chromium. There is no such thing as a salt of the brown oxide of chromium, for the reason that there is no such base.

It was the opinion of Döbereiner† that the substance produced by the calcination of the nitrate of chromic oxide was a chromate of chromic oxide and not an oxide of chromium, and he referred to the same formula the substances formed by the reduction of chromic acid by paper, and by the digestion of chromic oxide with chromic acid.

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* Schweigger, Jour. für Ch. u. Phys., XIII. 287 - 289 and 299 - 304.

† Ibid., XXII. 482 (1818).

Thomson[*] prepared a brown precipitate, which he called brown oxide of chromium, by passing a stream of sulphurous acid through a solution of chromate or bichromate of potash. We have found, as did Berthier,[†] that no precipitate whatever is produced by passing sulphurous acid through bichromate of potash; but this is a point of no importance in this connection. Thomson washed the precipitate which he had obtained for two months, and noticed the steady abstraction of chromic acid from the precipitate. He finally analyzed the washed oxide (as he called it) and made it to be a very basic chromate corresponding to the formula $(Cr_2O_3)_6\ CrO_3$. His opinion of the effect produced by the ignition of the nitrate of chromic oxide we have already cited. Under the head of chromate of chromium he remarks that, when chromic oxide is dissolved in chromic acid and the solution evaporated, there remains a substance quite similar in appearance to the brown oxide of chromium. Again, he observed the precipitate produced by mixing chromate of potash with sesquichloride of chromium, and says of it that it is evidently composed of chromic acid and the green oxide of chromium. Guided by the analogy of chromium and iron, he prepared a chromate of iron by mixing chromate of potash with sesquichloride of iron; an analysis of the edulcorated brown precipitate led him to the formula $(Fe_2O_3)_5\ CrO_3$, and in the filtrate and wash-water he thought he found another less basic chromate, corresponding to the formula $(Fe_2O_3)_5\ (CrO_3)_{2.5}$. On the whole, Thomson seems to have believed in the existence of a brown oxide of chromium, intermediate between chromic oxide and chromic acid; but every one of his experiments and analyses points directly to the conclusion, that the supposed oxide is in reality a chromate of chromic oxide, or rather in most cases an indeterminate mixture of chromic oxide and chromic acid.

We come now to the researches of Maus,[‡] contemporaneous with those of Thomson, but much more conclusive upon the disputed point as to the existence of a distinct oxide of chromium answering to the formula CrO_2. Maus mixed an aqueous solution of sesquichloride of chromium with chromate of potash, and digested the washed precipitate with acetate of lead, thereby obtaining a green solution of acetate of chromic oxide and a yellow precipitate of chromate of lead; he treated the same substance with arsenic acid, and obtained the insoluble arseniate of chromic oxide and chromic acid in solution. By washing the original precipitate for three weeks he claims to have removed all the chromic acid, and says that nothing but chromic oxide remained. By mixing sesquichloride of iron with chromate of potash he prepared a similar chromate of iron, from which all the chromic acid could be removed by washing in the same way. He believed that the calcination of the nitrate of chromic oxide produced a chromate of chromium, but containing always nitric acid, because a heat sufficient to drive off all the nitric acid also converted the chromate of chromium into chromic oxide. Maus did not analyze quantitatively any of these precipitates, probably because he was embarrassed by the impurities from which he could not free the precipitates without altering their composition; but his qualitative results are amply sufficient to prove that they all contained chromic acid as part of their original constitution. Maus did analyze two substances prepared by digesting chromic oxide and ferric oxide in chromic acid; the results of these analyses were, —

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[*] Phil. Trans., 1827, Part I. p. 186.

[†] Ann. der Ch. u. Pharm., XLVI. 185 (1843).

[‡] Pogg. Ann., IX. 127 (1827).

1.	2.
$Cr_2O_3 = 27.79$ per cent.	$Fe_2O_3 = 25.06$ per cent.
$CrO_3 = 72.21$ "	$CrO_3 = 74.94$ "

And he assigned to them the formulæ $Cr_2O_3\ 2\ CrO_3$ and $Fe_2O_3\ 2\ CrO_3$ respectively. These formulæ are incorrect; the figures of the first analysis would give about four equivalents of acid to one of the oxide, and those of the second analysis would give more than four equivalents of chromic acid to one of ferric oxide. Both substances were unquestionably indeterminate mixtures. Dumas, recounting the experiments of Maus, says, "These results would be decisive, but they are contested by Berzelius." * It is therefore necessary to review the opinions of Berzelius on this subject.

In 1814 Berzelius, writing an essay on the "Cause of Chemical Proportions," † mentions the new oxide of chromium, prepared by Vauquelin, intermediate between the green oxide and chromic acid. Berzelius

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* Traité de Chimie Appliq., (Liége, 1848,) VII. 319.

† Thomson's Ann. Phil., III. 104, (1814,) and Schweigger's Jour. für Ch. u. Phys., XXII. 56.

prepared this oxide, as he supposed, by igniting the nitrate of chromic oxide, observed the external properties of the substance, but did not analyze it, and made use of it only as an aid in establishing the contents of oxygen in chromic acid. In this essay he states the formulæ of the oxides of chromium as CrO_3, CrO_4, and CrO_6, the last being the acid. In a subsequent paper,* in speaking of the oxides of chromium, he lays special stress upon the close relation between manganese and chromium, and on the isomorphism of the sesquioxides of aluminum, chromium, manganese, and iron. He now writes the formula of chromic oxide as Cr_2O_3, and in all probability the peroxide of manganese (MnO_2) was in his mind an argument for the oxide CrO_2, though he does not mention it in the paper referred to. Finally, in 1829, Berzelius† rejects the conclusions arrived at by Maus, and gives the following reasons for his continued belief in the existence of the oxide CrO_2. The first reason urged is the analogy between the sulphur acids and the oxides of chromium; this comparison is based merely on the isomorphism of chromic and sulphuric acids. In the light of the better knowledge both of the sulphur acids and of the oxides of chromium which thirty years have given us, and with the clearer notions of chemical classification which now prevail, we can find in the existence of sulphurous acid no argument for the existence of an oxide of chromium containing two atoms of oxygen. Secondly, Berzelius gives his own idea of the reaction consequent upon mixing chromate of potash with sesquichloride of chromium, which he thinks is not correctly described by Maus; according to Berzelius, the decomposition between these two salts does not take place at once, but the mixed solution first becomes dark yellow, soon changes to brown, a brown precipitate separates, and the liquid remains brown; hence he infers the formation of two compounds of chromium and oxygen, one soluble and represented by the formula Cr_2O_5, the other the insoluble CrO_2. We have accurately described in the first sentences of this paper the phenomena presented on mixing a solution of sesquichloride of chromium with a solution of chromate of potash, and have subsequently given the formula which represents the reaction. There is no reason to suppose that any such compound as Cr_2O_5 remains in solution; when the brown precipitate first formed has completely subsided, the color of the filtrate is that of bichromate of potash. Lastly, Berzelius accounts for the fact that the supposed oxide yields to analysis chromic acid and chromic oxide by imagining that the original oxide is decomposed by contact with water into chromic acid and chromic oxide, as hyposulphurous acid is decomposed by water into sulphúrous acid and sulphur, or as nitrous acid is resolved by water above 0° into nitric oxide and a solution of nitric acid ($3\,NO_3 + Aq = 2\,NO_2 + NO_5 + Aq$). This might perhaps be a possible supposition, if the brown substance in question were prepared by methods in which water had no part; but when we see it precipitated from dilute solutions of monochromate of potash and a neutral chrome salt, or subsiding in the course of days from a very dilute solution of bichromate of potash, we are forced to the conclusion, that the substance is from the first composed of the chromic acid and chromic oxide which analysis shows it to contain. In short, we have all the evidence, analytical and synthetical, that this brown precipitate is a chromate of chromic oxide, which we have of the real constitution of sulphate of potash.

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* Pogg. Ann., VII. 415 (1826).

† In his Jahresbericht, VIII. 123.

The compound is well worthy the attention of those chemists who deny that formulæ ever express the actual constitution of bodies; it seems questionable whether any formula for the chromate of chromium can readily be written on the unitary theory which will express its properties and reactions as well as the dualistic formula. When at this distance we look back at the feebleness of the theoretical arguments which Berzelius opposed to the facts of Maus, Thomson, Döbereiner, and others, we marvel at the weight of a name whose authority outweighed the accumulated evidence of several trustworthy observers, and prevented the truth from prevailing thirty-four years ago. Berzelius himself became much less confident in after years of the truth of his earlier views; in his *Traité de Chimie*[*] he calls the precipitate formed by mixing a neutral chrome salt with chromate of potash, chromate of chromic oxide, and in a subsequent paragraph merely says that it is very possible that this compound is the oxide of chromium, CrO_2.

An observation made by Rammelsberg[†] added something to our knowledge of the precipitate formed by mixing a solution of chrome alum with a solution of chromate of potash. He made a determination of the water contained in the washed precipitate, and weighed the chromic oxide obtained by igniting it; the oxygen which was expelled by ignition was determined by loss. The analysis led to the formula $(Cr_2O_3)_3\,(CrO_3)_2 + 9\,HO$, showing that the washing of the precipitate had been sufficient to make it somewhat basic. The point specially noticeable in Rammelsberg's statement is his assertion that the precipitate was washed till it imparted no color to cold water. This is not credible, for the testimony of all other chemists is unanimous upon the point, that there is no limit to the removal of chromic acid by washing from this precipitate. We have often prepared much more basic precipitates, and have never yet seen colorless wash-water from the most basic of them. The color may become so pale as not to be very noticeable in small vessels.

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[*] II. 307 (Paris, 1846).

[†] Pogg. Ann., LXVIII. 274 (1846).

The discussion which we have traced left the subject in such doubt and obscurity, that most writers of text-books have given both views of the substance in question, some leaning to one theory of its composition, some to the other. In our endeavor to settle the question, we shall next bring to bear upon the subject the arguments to be drawn from analogy.

II. Analogous Chromates.

The metals with which chromium is allied are aluminum, iron, and manganese, and the existence of chromates of the sesquioxides of these metals with properties analogous to those which we have described as belonging to the chromate of chromic oxide, will be additional evidence that this substance is rightly so called.

1. *Chromate of Alumina.* Maus[*] observed, but did not analyze, the chromate of alumina which is precipitated when chromate of potash is added to a solution of alumina in chromic acid; he speaks of it as "consisting of chromic acid with much alumina." When the precipitate was thoroughly washed, pure hydrate of alumina remained on the filter and acid chromate of alumina passed into the filtrate. Fairrie[†] also describes a chromate of alumina prepared by mixing alum solution with the solution of chromate of potash, and his analysis led to the exact formula $Al_2O_3\ CrO_3$; he states, however, that the precipitate was thoroughly washed, which in connection with the result of his analysis is quite incomprehensible; for Maus observed, and our own experiments fully confirm his observation, that all the chromic acid may be readily washed out of this compound.

The yellow precipitate which appears when chromate of potash is dropped into a solution of alum, is constantly re-dissolved until the proportion of chromate of potash added amounts to five equivalents to each one of alum; the precipitate then becomes permanent; it is light yellow in color, and has a gelatinous appearance which suggests an excess of alumina. The reaction is evidently the same as that above given for the precipitation of chromate of chromic oxide. $5\,(KO\,CrO_3) + Al_2O_3\,3\,SO_3, KO\,SO_3 = 4\,(KO\,SO_3) + 2\,(KO\,2\,CrO_3) + Al_2O_3\,CrO_3$. The precipitate was drained, pressed between folds of filter-paper under heavy weights, and air-dried. The filtrate, when evaporated and crystallized, gave crystals of bichromate of potash, and of sulphate of potash mixed with the slight excess of chromate of potash. The presence of soluble salts in the pressed precipitate, and its decomposition by washing, determined us to the third method of analysis above described (p. 197). Omitting the subsidiary weighings, we give the essential figures of our first analysis of this substance.

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[*] Pogg. Ann., XI. 82 (1827).

[†] Jour. Chem. Soc., IV. 301 (1852).

Weight of the precipitate analyzed	0.5997 gram.
" " water found	0.1948 "
" " oxygen "	0.0197 "
" " soluble salts found	0.1969 "
" " mixed precipitate of $Cr_2O_3 + Al_2O_3$	0.1883 "

It will be remembered that the water and the precipitate of chromic oxide and alumina are actually weighed, the oxygen being determined by subtracting the water found from the total loss by ignition, and the soluble salts by subtracting the weight of the precipitate of chromic oxide and alumina from the weight of the whole residue after ignition. The amount of chromate of alumina corresponding to the oxygen lost by ignition may be calculated as follows:—ignition drives off half of the oxygen originally combined with the chromium; hence

Oxygen in the chromic acid of precipitate = 0.0394
Chromic acid corresponding to this oxygen = 0.0825
Chromate of alumina " " chromic acid = 0.1666

This calculation rests entirely upon the single determination of the oxygen, and an inspection of the steps of the process will show that any error in the amount of oxygen, or rather in the water determination on which the weight of oxygen depends, is multiplied by eight and a fraction in the calculated amount of chromate of alumina. A considerable discrepancy is therefore to be expected between the amount of chromate of alumina so calculated, and the amount actually found in the analysis, the sum of the oxygen and of the mixed precipitate of chromic oxide and alumina. That sum is in this analysis 0.208 gram.; subtracting the calculated amount 0.1666 gram., we find a discrepancy of 0.0414 gram. By subtracting 0.005 gram. only from the weight of the water determined, this error would be corrected, and the precipitate would coincide exactly with the formula $Al_2O_3\ CrO_3$, or, as the figures stand, its composition is very nearly that represented by the formula $(Al_2O_3)_3\ (CrO_3)_2$. Of course a method of analysis involving such a multiplication of an error, however small, is objectionable, but we were at a loss to devise a better. A second analysis gave a similar result; the discrepancy between the calculated and the actual numbers was four milligrammes larger than in the first analysis, and the figures of the analysis gave a chromate of alumina a little more basic than that represented by the formula $(Al_2O_3)_3\ (CrO_3)_2$. We attach very little importance to any such formula. The fact seems to be that the normal composition of the chromate of alumina precipitated by the double decomposition of alum and chromate of potash is represented by the formula $Al_2O_3\ CrO_3$, but that the compound is a feeble one, and parts readily with some of its chromic acid to the water of the solutions from which it is precipitated; hence the basic character of the precipitate analyzed. How Fairrie obtained a thoroughly washed chromate of alumina having the formula $Al_2O_3\ CrO_3$ is a mystery upon which our experiments have thrown no light.

2. *Chromate of Iron.* We have already cited the observations of Thomson concerning this chromate, which he found after washing to be very basic, and also the statement of Maus concerning the acid chromate of iron with four equivalents of chromic acid, obtained by digesting hydrated sesquioxide of iron in aqueous chromic acid. It remained for us to analyze, as exactly as the circumstances permit, the unwashed chromate of iron which is precipitated when chromate of potash is mixed with perchloride of iron. The method of analysis was the same as that used for chromate of alumina, with the disadvantage that the error in the amount of oxygen found is multiplied by ten instead of by eight in calculating the chromate of iron, because the atomic weight of the sesquioxide of iron is larger than that of alumina. The stability of the chromate of iron is greater, however, than that of the chromate of alumina, and the results of the analyses are very much nearer to the formula $Fe_2O_3\ CrO_3$, than those of chromate of alumina to the formula $Al_2O_3\ CrO_3$. The formula for the reaction whereby the brown chro-

mate of iron is precipitated, is the same as those already given for chromate of chromic oxide and chromate of alumina, viz.: —

$$Fe_2Cl_3 + 5\ (KO\ CrO_3) = 3\ (KCl) + 2\ (KO\ 2\ CrO_3) + Fe_2O_3\ CrO_3.$$

Until the requisite amount of chromate of potash had been added to the perchloride of iron, the precipitate re-dissolved; when it became permanent, it was drained, pressed, and air-dried for analysis.

Analysis 1.

Weight of the precipitate analyzed,	0.6626	gram.
" " water found,	0.0966	"
" " oxygen "	0.0395	"
" " soluble salts found,	0.2288	"
" " mixed precipitate of $Fe_2O_3 + Cr_2O_3$,	0.2977	"

From these data may be obtained by the necessary proportions, —

Oxygen in the chromic acid of precipitate,	0.0790
Chromic acid corresponding to this oxygen,	0.1654
Chromate of iron corresponding to this chromic acid,	0.4287

Chromate of iron found $= Fe_2O_3 + Cr_2O_3 + O$ weighed $= 0.3943$
Excess of the calculated chromate of iron over the found $= 0.0344$

This error would be perfectly corrected by a loss of three milligrammes in the water determination, or as the figures stand without any correction they would lead to the conclusion that the precipitate was a chromate of iron of the formula $Fe_2O_3\ CrO_3$, but containing a very small excess of chromic acid.

Analysis 2.

Weight of the precipitate analyzed,	0.6590
" " water found,	0.0990
" " oxygen "	0.0360
" " soluble salts found,	0.2254
" " mixed precipitate of $Fe_2O_3 + Cr_2O_3$,	0.2986

From these data may be obtained by the necessary proportions, —

Oxygen in the chromic acid of precipitate,	0.0720
Chromic acid corresponding to this oxygen,	0.1197
Chromate of iron corresponding to this chromic acid,	0.3597

Chromate of iron found = $Fe_2O_3 + Cr_2O_3 + O$ weighed = 0.3346
Excess of the calculated chromate of iron over the found = 0.0251

This error would be corrected by a supposed loss of little more than two milligrammes in the water determination. This second analysis, therefore, confirms the view that the normal composition of this chromate of iron is represented by the formula $Fe_2O_3\ CrO_3$.

It is unnecessary to call attention to the great similarity of the properties of the chromates of chromic oxide, ferric oxide, and alumina; their normal composition is represented by the formula $R_2O_3\ CrO_3$, but they are such feeble compounds as seldom to be found of the exact constitution which the formula indicates.* Of the three, the chromate of chromic oxide is the most stable, and we have been able to prepare it with the exact theoretical composition, from which it so easily varies. It should be observed, that a variation in the composition of these chromates, amounting to even ten per cent of their chromic acid, does not affect in the least their external properties, and it is by no means impossible that they are examples of that variation in the law of definite proportions which has been ably discussed by Professor J. P. Cooke in the Memoirs of this Academy; † but unfortunately, as must often be the case, the limits of error of our methods of analysis are wider than those of the supposed variation, and moreover, on this border-land between the kingdoms of Chemical and of Mechanical Force, there must always be doubt and difference of opinion concerning the cause to which a proved effect is to be ascribed.

3. *Chromate of Manganese.* The existence of this chromate has been so clearly demonstrated by previous observers that we have thought it unnecessary to add any experiments of our own. On mixing a solution of sulphate of the protoxide of manganese with a solution of chromate of potash, a chocolate-colored precipitate subsides after some time, to which Warington ‡ assigned the formula $(MnO)_2\ CrO_3\ 2\ HO$. Bensch § also analyzed a similar precipitate, for which he gives the same formula. In Warington's analysis the amount of protoxide of manganese is larger than the compound which his formula rep-

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* The monochromate of glucina mentioned by Gmelin (Handbook, IV. 155, Cavendish Soc. Ed.) evidently belongs to this class.

† New Series, V. pp. 348, 352 (1854).

‡ Phil. Mag., [3.] XXI. 380 (1842).

§ Pogg. Ann., LV. 98 (1842).

resents would contain, and it is, moreover, questionable if the protoxide of manganese could exist in contact with chromic acid. The subsequent observations of Fairrie[*] explain these difficulties. He mixed the solutions of chloride of manganese and chromate of potash, and so obtained a precipitate whose composition by analysis was $3\,(Mn_2O_3\ CrO_3) + Cr_2O_3 + 6\ HO$. Fairrie's criticism on the analyses of Warington and Bensch, that they overlooked the chromic oxide formed by the reaction, is no doubt just. He also remarks, that the precipitate appeared to be formed by the action of seven equivalents of chromate of potash on six equivalents of chloride of manganese, but offers no explanation of the reaction. The decomposition is explained by the formula,

$$7\,(KO\ \ CrO_3) + 6\,(MnCl) = 3\ Mn_2O_3\ CrO_3) + Cr_2O_3 + 6\,(K\,Cl) \\ + KO\ 2\ CrO_3.$$

Six equivalents of the protoxide of manganese are oxidized into three equivalents of sesquioxide of manganese, at the expense of the three atoms of oxygen which two equivalents of chromic acid give up in changing into one equivalent of chromic oxide; probably the chromic oxide so formed enters into combination with the chromate of manganese, rendering it basic. Chloride of potassium and bichromate of potash remain in the filtrate.[†]

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[*] Jour. Chem. Soc., IV. 300 (1852).

[†] We do not wish to leave the subject of the metallic chromates without noticing the remarkable analyses published by Malaguti and Sarzeau (Ann. de Ch. et de Phys., [3.] IX. 431, 1843) of the chromates of copper, zinc, cadmium, and nickel. The figures of these analyses correspond exactly with the following singular formulæ: —

$$\begin{array}{ll} (CuO)_4\ CrO_3 + 5\ HO, & (CdO)_5\ (CrO_3)_2 + 8\ HO, \\ (ZnO)_4\ CrO_3 + 5\ HO, & (NiO)_4\ CrO_3 + 6\ HO. \end{array}$$

All these precipitates were washed with boiling water till no color came from them, and it is clear that these chromates, like those which we have studied, may be deprived of the greater part of their chromic acid, if not the whole, by prolonged washing; hence the basic character of the substances analyzed. The marvel is, that the analyses corresponded so exactly with such peculiar formulæ; it is hardly conceivable that the publication of many analyses of each of these substances should not show the existence of a series of compounds, which conform to no definite formulæ.

III. THE BLACK OXIDE OF MANGANESE ($3\,MnO_2 = Mn_2O_3\,MnO_3$).

Another question now suggests itself, — Would analogy lead us to suppose that there was an oxide of chromium containing two atoms of oxygen? Comparing chromium, as before, with the allied metals, aluminum, iron, and manganese, we meet with no such oxide of aluminum, and we have Fremy's * direct statement that he could find no oxide of the formula FeO_2. Manganese, however, forms a compound with oxygen, stable, insoluble, and natural, which has heretofore always been spoken of as an oxide of manganese and been represented by the formula MnO_2. Is not the existence of this compound a strong argument for the oxide CrO_2? We propose to adduce the evidence which makes it most probable that this so-called peroxide of manganese is in reality a compound, sometimes definite but oftener indefinite, of manganic acid and manganic oxide, and that its normal composition is to be represented by the formula $Mn_2O_3\,MnO_3$.

We shall not expect to resolve this substance into manganic oxide and manganic acid with the same facility with which we analyze the chromate of chromic oxide. This latter body is less stable than either chromic oxide or chromic acid, whereas manganic acid and oxide are both exceedingly unstable substances, obtained with difficulty but easily destroyed. On the other hand, there is no more stable compound of manganese than that called the peroxide. It is not therefore decomposed, as the chromate of chromium is, by boiling water, boiling caustic potash, or a boiling solution of chloride of ammonium. We prepared artificial peroxide of manganese by passing a stream of chlorine through water in which carbonate of protoxide of manganese was diffused, and washing the precipitate, first with dilute nitric acid and then with water. The artificial peroxide thus prepared resisted solutions of chloride of sodium and of caustic potash, even when heated with these liquids in closed tubes to a temperature of 180° by means of a wax bath.

But, notwithstanding the stability of this black oxide of manganese, it is not impossible to obtain from it manganic acid under circumstances which seem to preclude the possibility of any oxidation of the substance during the process by which the manganic acid is exhibited. Mitscherlich † observed and reported the formation of the green manganate of

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* Ann. de Ch. et de Phys., [3.] XII. 381.

† Abhandlungen der Akademie der Wiss. zu Berlin, 1831, p. 218. Ann. de Ch. et de Phys., [2.] XLIX. 114. Pogg. Ann., XXV. 287.

potash, when caustic potash is fused in a retort with peroxide of manganese *without access of air.* Upon such authority this statement must have great weight, although the omission of the details of the experiments renders it impossible to form any opinion of the sufficiency of the evidence upon which it rests. Fortunately the results of Mitscherlich find full confirmation in the recent experiments of Bekétoff.* This observer has shown that, when a mixture of caustic potash and black oxide of manganese is heated, in a closed tube filled with oxygen, to a temperature of 180°, an abundance of the green manganate of potash is formed *without the slightest absorption of oxygen.* Unless these experimental results can be disproved, it seems impossible to escape the conclusion that the substance called peroxide of manganese contains manganic acid, since it yields manganic acid while the ratio of its manganese to its oxygen remains unchanged.

In 1817 Chevillot and Edwards† published an account of some experiments in which they endeavored to prove that the presence of air or oxygen was absolutely necessary to the formation of chameleon from caustic potash and black oxide of manganese. To demonstrate this, they first heated the mixture of these two substances in a silver crucible, within a glass vessel which was filled with nitrogen, and found that no manganate of potash was produced. The amount of heat applied is not stated, but the nature of the apparatus indicates that a high temperature was used. Secondly, they heated the same mixture of caustic potash and black oxide of manganese in an atmosphere of oxygen, and measured the considerable quantity of oxygen absorbed during the formation of the manganate. These experiments seem at first sight absolutely to contradict those of Mitscherlich and Bekétoff; but it is easy to show that they have no such tendency, and that the conclusions which Chevillot and Edwards drew from them were entirely erroneous, though the experiments themselves were perfectly correct and faithfully reported. It is obvious that an absorption of oxygen is just as necessary in order to convert the substance, whose formula would be written $Mn_2O_3\ MnO_3$, *completely* into manganic acid, as it is for the entire conversion of the so-called oxide MnO_2 into the same acid. The same amount of oxygen must be absorbed in changing one gramme of the black oxide of manganese into manganic acid, however the rational formula of that substance may be written. To prove that oxygen is absorbed during the formation of manganate of potash from caustic potash and black oxide of manganese, is therefore not at all to the purpose; the only question is, Can *any* manganate be formed *without* absorption of oxygen? This question the experiments of Mitscherlich and Bekétoff answer in the affirmative. But if manganate of potash is formed from caustic potash and black oxide of manganese without any addition of oxygen, how is the fact of its non-formation in an atmosphere of nitrogen, as proved by Chevillot and Edwards, to be accounted for. We have repeated the experiments of Chevillot and Edwards with a somewhat different apparatus. A combustion-tube of small diameter was nearly filled with copper turnings, and beyond the copper a platinum boat containing a mixture of caustic potash and peroxide of manganese was inserted. The tube was then connected with an aspirator, and a slow current of air was drawn through the hot copper. When time enough had elapsed to secure the complete filling of the tube with nitrogen, the platinum boat was heated gradually up to dull redness without producing a trace of the green manganate. When the tube had cooled, the contents of the boat was a fused, brownish mass. Another experiment, however, showed conclusively that the non-appearance of the green manganate is accounted for by the fact that this manganate cannot exist in an atmosphere of nitrogen at such a temperature. We prepared some manganate of potash in a platinum boat by fusing a mixture of carbonate of potash and black oxide of manganese in the air, and then heated this boat with its contents in an atmosphere of nitrogen by means of the apparatus just described. At a temperature very much below a red heat every trace of the green manganate disappeared, and when the tube was cool the appearance of the contents of the boat was that of a fused, brownish mass, precisely like that described above in the former experiment. Repetitions of the experiments fully confirmed these results, which perhaps ought to have been anticipated, since it seems more than probable that nitrogen would be oxidized in contact with a hot manganate. Similar experiments with an atmosphere of carbonic acid led to the same negative results. It must be borne in mind that our present purpose is merely to show the fallacy of the inferences which Chevillot and Edwards drew from their experiments, which were made at an uncertain but high temperature. We by no means wish to assert that it is impossible to obtain the green manganate of potash from a mixture of caustic potash and black oxide of manganese in an atmosphere of nitrogen, if the temperature be sufficiently low. On the contrary, we have made several experiments which tend to the conclusion that this is perfectly possible under certain conditions. A mixture of caustic potash and natural black oxide of manganese was placed in a glass tube, which was then filled with nitrogen and sealed. Thus hermetically closed, the tube was heated in a wax-bath to 180° for three hours; at the end of the experiment, we found that portions of the mass in the tube had been changed into green manganate of potash, though the greater part seemed to be unaltered. Again, a mixture of potash and the black oxide, artificially prepared, was gently heated in a combustion-tube in a current of nitrogen to a temperature barely high enough to fuse the mass, and the manganate of potash was formed, small in amount, but perfectly unmistakable. In repeating this last experiment, however, we failed quite as often as we succeeded, for it is difficult to heat the mixture hot enough to insure the formation of the manganate without also heating it hot enough to destroy it. Moreover, no experiments, intended to exhibit the formation of manganate of potash in nitrogen from potash and the black oxide, can be conclusive, so long as the experimenter is unable to answer any one who may please to allege that the nitrogen used contained a trace of oxygen. Unless some method of preparing the nitrogen is used which will enable the chemist to assert that the gas is free from oxygen and from all other impurities which might affect the reaction, such experiments will establish nothing. The only conclusive method of testing the question whether manganate of potash can be formed from the black oxide and potash alone, is that so well applied by Bekétoff, who proved that the manganate can be produced from these materials in an atmosphere of oxygen at a low temperature without the slightest absorption of that gas. His experiments were obviously performed with such care that we have thought it superfluous to repeat them.

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* Bulletin de Soc. Chim. de Paris, Séance 13 Mai, 1859, I. 43.

† Ann. de Ch. et de Phys., [2.] IV. 290.

We have been at such pains to review and explain the experiments of Chevillot and Edwards, in order to put the decomposition of the substance called peroxide of manganese into manganic oxide and manganic acid in its true light, as an uncontradicted fact, resting upon the highest authority. If we add to this decomposition of the black oxide of manganese by potash the other fact, that it is a perfectly neutral or indifferent body, possessing none of the properties either of an acid or of a base, we have evidence, not sufficient perhaps absolutely to prove that its true rational formula is $Mn_2O_3\ MnO_3$, but quite enough to show that the formula MnO_2 is no argument for the formula CrO_2, in the face of the demonstration of the true character of the chromate of chromium heretofore given. On the contrary, the fact that the supposed brown oxide of chromium is in reality composed of chromic oxide and chromic acid, gives additional weight to the experimental evidence already accumulated, that the peroxide of manganese is a compound of manganic oxide and manganic acid. There is a striking similarity between the methods of preparing chromate of chromium and manganate of manganese, the more noticeable in view of the very different stabilities and solubilities of the oxides of these two metals. Thus the action of chlorine on chromic oxide gives rise to the formation of chromate of chromium, while its action on the carbonate of manganous oxide produces the manganate of manganese.* Again, the gentle ignition of the nitrate of manganous oxide produces a mixture of manganous oxide with the higher oxides of manganese; this mixture contains so much manganate of manganese that the process has been patented as a method of obtaining a manganese oxide adapted to the preparation of chlorine.† This result corresponds precisely with the result of igniting the nitrate of chromic oxide. Again, the absorption of oxygen by heated chromic oxide exposed to the air, observed by Krüger, finds its exact parallel in the absorption of oxygen by manganous oxide under the same circumstances. A mixture of the higher oxides of manganese is so obtained, and this process of ignition has been long known in the arts as a means of "revivifying" black oxide of manganese, rendering it available for the preparation of chlorine a second time, or through an indefinite series of alternate reductions and oxidations.‡

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* Gmelin's Handbook of Chemistry, IV. 207, Cavendish Soc. Ed.

† Berthier, Ann. de Chim. et de Phys., [2.] XX. 187. Gatty, Eng. Patent Specifications, 22 Aug. 1857, No. 2230, p. 3.

‡ Pfaff. Schweigger's Jour. für Ch. u. Phys., LIII. 122, (1828).
Binks, C. Eng. Patent Specifications, 8 Feb. 1839, No. 7963, pp. 4, 8, and 9.
Ebelmen. Ann. des Mines, [3.] XVII. 517 (1840).
Walters, G. S. Eng. Patent Specifications, 24 Mar. 1843, No. 9676.
Balmain, W. H. " " " 31 Mar. 1855, No. 723, p. 4.
Dunlop. " " " 22 Nov. 1855, No. 2637, p. 3.
Barrow. " " " 26 Feb. 1856, No. 485, pp. 4, 9.
Elliot. " " " 13 Oct. 1856, No. 2392, p. 4.
Pattinson. " " " 21 Oct. 1856, No. 2475.
Gossage. " " " 8 Nov. 1856, No. 2630, p. 7.
Reissig. Ann. der Ch. u. Pharm., CIII. 27 (1857).
In several of these specifications the removal of alumina and sesquioxide of iron

While it is much easier to obtain the manganate of manganese in a state of tolerable purity than it is to prepare the chromate of chromium, because of the greater insolubility of the first substance, it would nevertheless be very difficult, to say the least, to precipitate it by the method of double decomposition. We can readily mix chromate of potash and a normal salt of chromic oxide, and throw down the chromate of chromic oxide: till we can prepare a pure and neutral manganate of potash, the true composition of the manganate of manganic oxide cannot be illustrated in this way.

IV. Other Chromates of Chromic Oxide.

Under the head of "Bichromate of Chromic Oxide" the English Editor of Gmelin's Handbook of Chemistry * has described two processes, neither of which has any connection with the name and formula at the head of the paragraph; the first is the description of a washed, and therefore basic, chromate of chromic oxide, prepared by Traube,† identical with the substance analyzed by Rammelsberg, as Traube himself remarks, and having the same formula by Traube's analysis, viz. $(Cr_2 O_3)_3 (CrO_3)_2$; the second is the description of the mode of precipitating the chromate of chromic oxide, Cr_2O_3 CrO_3, from chrome alum by chromate of potash in the manner we have fully explained.

For the existence of what the translator of Gmelin's ‡ Handbook calls the "Neutral Chromate of Chromic Oxide," with the formula Cr_2O_3 3 CrO_3, there seems to be no sufficient evidence. Unverdorben, Berzelius, and Maus have proved beyond a question, what hardly required proof, that when heated above the melting point chromic acid is ultimately resolved into oxygen and chromic oxide. Traube § has thought to show that by using a temperature but little above 250° a definite chromate can be obtained, corresponding to the formula Cr_2O_3 3 CrO_3. By heating a quantity of chromic acid to this re-

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is described, preparatory to the roasting of the manganous salt or oxide. The more manganic acid formed by the roasting the better, — may not then the admixture of a certain amount of these bases be chemically advantageous? Very possibly there are mechanical advantages to be gained by their removal.

* Handbook of Chemistry, IV. 115 (Cavendish Soc. Ed.).

† Ann. der Ch. u. Pharm., LXVI. 108 (1848).

‡ Handbook of Chemistry, IV. 116 (Cavendish Soc. Ed.).

§ Ann. der Ch. u. Pharm., LXVI. 106 (1848).

quired temperature he obtained a black mass which had taken the shape of the crucible; this he powdered and digested with water, with the expectation of dissolving that portion of the chromic acid which had not been affected by the heat; the wash-water after some days still remaining yellow, he concluded that the substance itself gradually dissolved, and proved this to his own satisfaction by analyzing two portions, one of which had been washed more than the other, with the same result, viz. 57.93 per cent of chromium and 42.07 of oxygen. These figures correspond to the formula Cr_2O_3 3 CrO_3. Now chromic acid contains 52.23 per cent of chromium and chromic oxide 68.62 per cent, and in changing from the first into the second, under the influence of a moderate heat, the heated substance will at some moment contain 57.93 per cent of chromium; before that moment it would contain less, after that moment more. We were not so fortunate as to hit on the right time for stopping the experiment. We subjected a mass of chromic acid to a temperature a little above 250° for three hours, and obtained a brownish black substance, such as Traube has described, which, powdered and boiled with water, imparted a faint yellow color to the liquid. Analysis showed that it contained 54.12 per cent of chromium. It is quite clear that any substance prepared in such a way must be a mixture, and that the particular mixture analyzed by Traube has no claim to the name and formula of a definite compound.

Still another hypothetical chromate, called "Soluble Brown Chromic Oxide or Acid Chromate of Chromic Oxide," figures in Gmelin's Handbook (*loc. cit.*). Maus and many others have made a solution of hydrated chromic oxide in aqueous chromic acid, but Maus alone has analyzed the solution; we have already expressed our opinion that the liquid he analyzed was only an indeterminate mixture (p. 211). The observation and the conjecture of Berzelius, cited by Gmelin in this paragraph, we have already remarked upon; the precipitate which Berzelius speaks of is the chromate of the formula Cr_2O_3 CrO_3.

To sum up the case, — there is not a particle of evidence of the existence of any chromate of chromium containing more than one equivalent of chromic acid. Such may be hereafter discovered, but it does not seem probable that they will be found to be insoluble compounds. Until the realities are made known to us, why cumber the science with names and formulæ, which fill no gaps, extend no analogies, bridge no difficulties, but are merely a perplexity and a hinderance? It has been too much the custom to call the chromate of the formula Cr_2O_3 CrO_3

the *basic* chromate of chromium; this proceeds on the assumption that there is some other salt better entitled to the name of normal or neutral chromate, as, for example, the imaginary chromate containing three equivalents of chromic acid. Until some such chromate is discovered, the word *basic* would be better omitted from the name of the only definitely determined chromate of chromium.

Professor G. P. Bond exhibited a drawing of the great nebula surrounding the star θ Orionis representing its appearance in the twenty-three-foot refractor of the Observatory of Harvard College.

The feature to which attention was particularly directed was the spiral structure of the principal masses of light, or, more correctly, the tendency to an arrangement in elongated wisps or whirls, sweeping outward from the bright region of the Trapezium. A disposition of the nebulosity in some localities to radiate from the vicinity of the Trapezium, noticed in the memoir published by Professor W. C. Bond in 1848, has repeatedly attracted attention in subsequent years. The idea of a spiral character in the radiations had even been suggested, without however presenting itself definitely to the mind as the true conception of the leading features of the nebula.

During the past winter, opportunities were taken to review the whole region, with particular reference to this peculiarity; attention being given exclusively to the arrangement of the diverging wisps of nebulosity, and the alternating dark spaces by which they are separated from each other. A particular scrutiny of the latter was of considerable assistance in tracing the fainter convolutions. The form and disposition of the whirls were thus defined by two independent processes, the nebula being first sketched as a bright object on a dark ground, and, again, its darker openings and channels as dark objects on a white ground.

The quarter designated in Herschel's chart* as the *Regio Godiniana* was first explored. The nebulosity was here resolved into an assemblage of three or four long wisps, interlaced with each other, or crossed by offsets; these were ultimately traced from a point near the northern margin of the *Sinus Magnus*, over the whole length of the *Regio Picardiana* and the *Regio Godiniana*, forming a sweep of 120°. After passing the well-defined northern boundary of the last-named region, and beyond Herschel's stars *o* and *ξ*, these wreaths bend rather suddenly, and tend towards the south-preceding direction. Indications of their presence in this quarter are imperfectly suggested in Lassell's and in Sir J. Herschel's latest drawing. From this point feeble traces exist for 10′ or 15′ in a south-preceding direction. Their course over the *R. Picardiana* gives a decidedly reticulated aspect to the whole region; but, though bright, they are here so closely intertwined and connected by offsets, that it is a matter of no little difficulty to gain a clear comprehension of their proper relations. The complexity of the details is further increased by several offshoots from this quarter, which cross over into the adjacent *R. Derhamiana;* still the general effect is easily recognized.

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* Mem. Astr. Soc., Vol. II.

From the southern corner of the *Regio Picardiana*, and from those parts of *R. Derhamiana* and *R. Huygeniana* which lie near the Trapezium on its north-preceding and preceding sides, a number of narrow and bright branches diverge, their extremities tending also to the south-preceding direction. Some of these cross the *R. Gentiliana* and seem to merge together, forming a nebulous mass, which can be followed through an arc of 10′ or 15′. Others, which are less curved, originate near the *Sinus Gentilii;* these are narrow and somewhat tortuous.

It is to be noticed that the initial direction of the wreaths (*Nebelstreifen*) changes continuously from an angle of position of 330° on the northern margin of the *Sinus Magnus*, to one of 220°, or less, at the *S. Gentilii*, and the sweep of the curve correspondingly diminishes, so that throughout the whole nebulous region preceding the sharply defined apex of the *R. Huygeniana*, the extremities of the filaments have a pretty uniform tendency in the angle of position 220°. As soon, however, as we pass to the fields on the following side of the apex, a change is immediately apparent. The ultimate direction being about in the angle 160°. The principal group of wisps results from the resolution of the *R. Messeriana*, and the region between the Trapezium and the *Proboscis Minor*, including both these features, into four or five distinct wreaths having a common initial direction in the angle of position 110°. The very bright nebulosity lying between the *S. Gentilii*, the Trapezium, and the *R. Subnebulosa*, cannot be resolved into a regular structure, but three or four condensed spots, constituting the most brilliant part of the nebula close on the south-preceding side of the Trapezium, are plainly distinguished as tufts or curled offsets from a prominent wisp of light which extends from its origin, near the Trapezium, across the *R. Gentiliana.*

The general aspect of the greater part of the nebula is therefore that of an assemblage of curved wisps of luminous matter, which, branching outward from a common origin in the bright masses in the vicinity of the Trapezium, sweep towards a southerly direction, on either side of an axis passing through the apex of the *Regio Huygeniana*, nearly in the angle of position 180°. About twenty of these convolutions have been distinctly traced, while others giving a like impression are too faint or too intricate to be subjected to precise description. It may therefore be properly classed among "the spiral nebulæ," under the definition given by their first discoverer, Lord Rosse; including in the term all objects in which a curvilinear arrangement, not consisting of regular re-entering curves, may be detected.

That the existence of this feature in the great nebula of Orion should have hitherto escaped notice, after the many careful scrutinies to which it has been subjected, with the help of the largest instruments and the most skilful observers, may seem scarcely credible; a few words of explanation on this point will not therefore be amiss. It is to be ascribed partly to the confusing effect produced by the crossing and intersection of the principal *striæ* and of their offsets, which the eye cannot unravel without the aid of some clew to their mutual relation and significance; and partly also to the faintness of some of the details, which are, nevertheless, very essential features in a correct apprehension of its structure, supplying, as they do, what would otherwise appear as breaks of continuity, and assisting materially in the recognition of a principle of regularity pervading the whole structure. Until the law of relation and continuity in the several parts of such an object is entertained in the mind, it must remain an incoherent, confused assemblage of material, having no orderly or connected arrangement.

The change from the previous notion of its configuration is not more considerable than that which took place with reference to the celebrated nebula 51 Messier, in which the original discovery of the spiral arrangement was made. This object had been subjected to a careful examination and description by both the Herschels, but neither their drawings nor descriptions furnished the slightest intimation of a spiral structure. It deserves particular notice, too, that there was no want of sufficient optical power to exhibit the appearance in question; for the spirality of 51 Messier is seen with perfect distinctness in a refractor of 15 inches' aperture, and must certainly be within reach of the twenty-foot Herschelian reflectors. Nor can it for a moment be thought that the earlier observations and delineations were in any proper sense erroneous. They were simply made at a great disadvantage, in the absence of a clear conception of the general plan of structure presented in the object. Some of the details indispensable to its recognition, being only faintly presented, were overlooked, or, appearing by mere suggestions and glimpses of vision, they conveyed an erroneous impression; in this way the mutual relation of the various parts came to be entirely misconceived. The missing links were supplied by the larger optical power of Lord Rosse's telescope, too plainly not to insure notice; and the nebula then presented itself under a totally different aspect. Instances of similar revelations, completely at variance with previous conjectures, have indeed so often occurred in the history of astronomical discovery, that the process ought to be regarded as the ordinary rule, rather than as an unusual exception.

Professor Bowen read a paper arguing against the wisdom of legal enactments requiring banks to keep a fixed and constant proportion of specie in reserve.

Mr. Felton read a paper on the honey of Mount Hymettus, of which he had received a supply from the Rev. Dr. Hill of Athens. He gave an account of the Grecian bee, citing passages from the poets, beginning with Homer: next, the various occasions, religious and social, on which honey was used by the ancients were enumerated. The employment of honey in the medical practice of the Athenian physicians, especially by Hippocrates and Galen, was explained, and passages were cited from the writings of Hippocrates. The next topic was a philological one, the use of honey as a term of comparison, and the frequency with which the word μέλι (honey) is compounded with other words in descriptive epithets. This was shown by a series of passages in the poets and prose-writers, from Homer to Plato and Aristotle. The reputation of the honey of Mt. Hymettus in ancient times was then illustrated by quotations from Strabo and Pliny; and in modern times, by the testimony of the old traveller, Wheeler, and others. The wild thyme which flourishes in abundance on the mountain, and which gives its peculiar flavor and fragrance to the honey, was described, and specimens exhibited.

Greece has been overrun, it was remarked, by hostile and barbarous hordes. Persians, Gauls, Romans, Vandals, Goths, Slavonians, Albanians, and Turks have successively swept over the land, until some, like Fallmereyer, have come to the conclusion that the ancient Hellenic population have been utterly displaced, and not a drop of Hellenic blood flows in Grecian veins. This is a paradox, as any one may see who will visit Dr. Hill's school or the Panepistemion of Otho, or the Parthenagogeion, and look into the animated countenances which might furnish models for another Panathenaic procession. But let the speculative sceptic doubt this if he pleases; even he cannot doubt that the bees of Hymettus are descended in a bee-line from those that clustered round the lips of the infant Plato as he slept among the myrtles while his parents were sacrificing to the Hymettian nymphs.

"And still his honeyed wealth Hymettus yields;
There the blithe bee his fragrant fortress builds,
The free-born wanderer of thy mountain air."

A small quantity of the Hymettus honey was placed on the table as a further and final illustration of the subject.

Four hundred and ninety-fourth meeting.

April 11, 1861. — MONTHLY MEETING.

The PRESIDENT in the chair.

Mr. Charles G. Loring announced the death, upon the same day, of two venerable and distinguished Fellows of the Academy, viz. Chief Justice Shaw and Judge White, in the following terms: —

Mr. President: Since the last meeting of the Academy, and within the lapse indeed of a few days, two of its most venerated members, whose age, social position, and eminent endowments added much to its dignity and influence, having been called from earth by the angel of death, it becomes us to turn from our ordinary avocations for a moment in contemplation of their departure, and to place upon record a testimonial of our appreciation of their worth. And as both were in the department in the classification of members in which I stand, and as long and very friendly professional and social relations with one, and a cordial acquaintance for many years with the other, have rendered my remembrance of each of peculiar and affectionate interest, I readily comply with your suggestion, in a very humble and brief attempt to commemorate their claims upon our regard this evening,—confining myself to the consideration of their peculiar moral and intellectual characteristics, leaving the more particular elements of biographical account for their appropriate place in the annual narrative.

If I were influenced by no other motive to avoid all semblance of exaggeration in such delineations, I should feel myself constrained to the severest simplicity of truthfulness by the consciousness of the stern reverence of it in one, and the equally firm and gentle love of it in the other, as illustrated in their daily lives and conversation, and of the reproach pressing on me, as in their presence, should I be guilty of departure from it in speaking of them.

Both were members of the legal profession; both devoted their best energies to the service of society in that department of moral science; and both illustrated its true dignity as a science in knowledge of the principles of human nature and of society; and as an art, in the application of them to the relations of life and the rights and duties of members of a community.

I believe that the records of the juridical career of the late Chief Justice Shaw justify the assertion, that no judge ever adorned the bench, in England or America, whose decisions are more strikingly illustrative of the law as a science, both in the abstract and the concrete. His mind seemed ever dwelling in principles and their unfoldings; and with equal power and delight whether in abstract development or practical application. It was thoroughly absorbed in the perception and contemplation of the nature of Law, in its universal application, as portrayed in Hooker's celebrated description: "Of Law there can be no less acknowledged than that her seat is in the bosom of God,—her voice the harmony of the world; all things in heaven and earth do her homage, the very least as feeling her care, and the greatest as not exempted from her power."

No subject was presented, whether of morality or civil polity, of science or of art, concerning which he did not instinctively seek the ascertainment of its fundamental law, its reduction to first principles. It mattered not whether it were the government of a state or the construction of a contract; the revolution of a comet or the circulation of the blood; the working of a steam-engine, or a machine for the manufacture of a pin.

This great faculty of perceiving and developing the principle of everything brought within the range of his intellectual vision, was the foundation of his imposing mental power; and had it stood alone, and been exercised and expended in abstract research and the development of systems, embodied in scientific treatises, there can be no doubt that it would have ranked him among the men of genius of his day, and transmitted his name to posterity with a more dazzling diadem than ever rests upon the brow of those whose lives and powers are devoted to the service of man in the daily walks of life.

But happily for our Commonwealth, and happily, I may safely say, for the jurisprudence of our country, this was but one, though the most conspicuous, of the many talents with which he was gifted, and which enabled him to extend broadly and deeply the foundations of jurisprudence in its adaptations to the ever-changing phases of human life in the progress of civilization, and the ever-novel and multifarious developments of industrial skill and enterprise. To this great power were added the willing capacity for long-continued labor in details; an earnest love and curiosity for the application of principles to practice; a ready faculty for subtile logic, rejoicing in the play and conflict of polemic discussion; a marvellous faculty of individualization, from which nothing escaped; a comprehensive, tenacious memory; and, perhaps above all, a great heart filled with generous dispositions and kindly emotions, an incarnation of the sentiment, "Homo sum, humani nihil a me alienum puto," ever impelling to the use of all his faculties and attainments for the service of his fellow-men in all that was nearest to their interests and their affections.

Human law is but the reflex of the habitual feelings and opinions of the people. The law of causality is as strictly applicable to human actions as to the world of matter. Law is therefore in the strictest sense a science, whose fundamental principles are to be found in the construction of human nature and civil society; and he only can be esteemed a scientific lawyer whose studies and reflections extend beyond the learning of books and the authority of precedents — essential instruments and guides though they be in his daily work — to the sources of individual and social, intellectual and moral life.

No code of statute law, however elaborate, or erected upon experience however universal, could provide for a multitude of novel cases that would be presented for adjudication within one year after its enactment. The infinite variety of human capacities, feelings, interests, and motives, and the ever-multiplying novelties in enterprise and social relations, must ever throw back legal judgment on rights and duties in human life upon first principles; and hence the inevitable necessity for what is termed judicial legislation,—the establishment of the law by the court in an individual case, to govern all thereafter arising, falling within the like application of the same principles. And no department of human labor, therefore, in science or art, calls for greater capacity of comprehension and investigation, more acute penetration and far-seeing wisdom, or more entire soundness of heart, than that of the judgment seat. And more especially is this combination of faculties demanded at periods when the expansion of commerce and of business relations to new dimensions and in multiplied varieties, and the introduction of new modes of enterprise, call for a corresponding enlargement of the foundations and boundaries of jurisprudence.

And it was at such a stage in the affairs of men that this great judge was commissioned for his high trust. The changes and modifications of public sentiment concerning laws regulating the domestic relations; the vast and rapidly augmenting increase of commercial adventure, involving corresponding multiplied connections and calling into birth new species and forms of obligation, written and implied; the comparatively recent introduction of a new system of associated enterprise in manufacturing corporations, already widely spread if not originating in New England, and before unknown; and the gradual ingrafting of the English system of Equity Jurisprudence upon the administrative duties of our courts of common law, opened wide and constantly enlarging fields for the development of principles of previous comparatively limited application, and for the unfolding of others, before unrecognized, lying at the foundation of the new combinations thus brought into being. Happily his associates upon the bench, at his accession to it, were also men of eminent ability and great learning, and some of them of long judicial experience; thus with him constituting a combination of intellectual power and moral influence remarkably adapted for the existing and coming emergencies, for maintaining the pre-eminence of the Commonwealth in these new fields of science which their predecessors had established in the old, and for transmitting to posterity her system of jurisprudence with broader foundations and ampler superstructure, adapted to the unprecedented and ever-increasing growth of her material interests, and, as it may be hoped, of her ever-advancing progress in moral and intellectual civilization. And it is believed that she can point to no one of her many illustrious sons whose intellectual power, faithful service, and moral influence have done more for the honor and perpetuity of her most cherished civil institutions.

But the services of this great and good man were not confined to the discharge of his official duties; his comprehensive mind and heart embraced all fields in which he could serve his fellow-men; his broad and philosophical benevolence assisted in the management and dispensation of many public charities; his love of learning and appreciation of the inestimable benefits of thorough science, and his profound wisdom, aided in the government of many institutions for their cultivation. He was for more than twenty years a member of the Corporation of Harvard College, ever faithfully attentive to the laborious and often minute duties of that station, and earnestly intent upon the promotion of her highest interest and honorable fame.

The moral nature of Chief Justice Shaw was on the same grand scale with the intellectual. It was founded upon a firm will and courageous spirit, fitting him for enduring enterprise and resolute fulfilment of his purpose. His perception of duty was elevated and controlling; his regard for truth stern and unyielding; his sense of justice acute and comprehensive, generous and benevolent; and crowning all was a warmth and sensitiveness of feeling often in seemingly strange contrast with his otherwise massive character. He was singularly emotional; the utterance of a noble sentiment, the witnessing of a generous action, the unexpected appeal to any of the exalted principles of our nature, the suffering of a fellow-being, however humble, would suffuse his eyes and cause his lips to quiver and his voice to tremble, alike on the judgment seat and in the privacy of social intercourse. Had he lived in earlier times it might well be believed that his demeanor upon the bench had prompted the apothegm, "The sentence of condemnation is best steeped in the judge's tears." Indeed, in witnessing his discharge of this painful duty of his office upon the prisoner, it was often difficult to believe that he was not at the time the greater sufferer of the two. In private life our departed associate was an earnest, faithful friend, a genial and most instructive companion. His resources in general information upon the science, literature, and humanities of the day, seemingly marvellous in contemplation of the absorbing duties of his office; his rich fund of racy anecdote and illustrative historic remembrances; a keen relish of wit and humor, and the faculty to contribute his share of them; and a cordial enjoyment of social intercourse in all its refined and elevated forms, ever rendered him a gladly welcomed and honored guest, though ever in seeming unconsciousness "wearing the kingly crown" of acknowledged intellectual and moral power.

Into the sanctities of his domestic life, and the sorrows of those most dear to him and to whom he was most dear, it is not for us to intrude, further than in expression of our sympathy in the grief attending the final departure of the venerated and beloved from the home which he had so long blessed and adorned, and where he so faithfully illustrated the highest virtues of the husband, father, and friend.

In the Christian faith and hope, by the light and guidance of which he had lived, he serenely reached the close of his long, laborious, successful, and honored life, dying in the confidence that, though "the dust shall return to the earth as it was, the spirit shall return to God who gave it."

In turning from the contemplation of the life and character of Chief Justice Shaw, to those of the other venerated and distinguished member of the Academy, whose place was on the same day and nearly at the same hour made vacant, I feel still more impressively a painful inability to approach any just presentation of them; and lament that a duty so grateful as this must have been to one of his intimate associates, has not devolved upon some one thus privileged, and more familiar with the studies and learning which were the joy and crowning glory of his life.

The late Judge Daniel Appleton White, although not so prominently known to public fame as his cherished friend of whom we have just spoken, nor occupying a like elevated official position, held a high rank in the department of letters, and exercised a wide-spread and beneficent public influence. He probably had few superiors in this country as a scholar in English literature, to which his life was mainly devoted; and certainly he had none in the virtues and graces of a Christian gentleman, neighbor, friend, and patriot.

Having been graduated with the highest honors of the University, and officiated for four years as its Tutor in Latin, he entered upon the study and practice of the law; and soon made such progress as raised high expectations of future eminence, and led to his election as a Representative in the Congress of the United States. Entertaining, however, no ambition for popular distinction, and preferring a sphere of life more congenial to his peculiar faculties and tastes, he resigned that station before entering upon its duties, and accepted the office of Judge of Probate for the County of Essex, — a station of far greater importance to the domestic peace and welfare of the community than is generally understood, involving indeed great responsibilities, and requiring for the due discharge of its duties thorough knowledge of a peculiar department of law, sound judgment, gentleness of manner, beneficent patience, and spotless integrity; but absorbing no time beyond the special days appropriated for their administration, and leaving a large portion therefore for other pursuits. He retained this office for the period of thirty-eight years, fulfilling its duties not only to entire acceptance, but in such manner as to attract a degree of veneration and affectionate confidence throughout the county.

But great as must have been the satisfaction from the consciousness of duty thus discharged, and without which one of his philanthropic affections and high sense of obligation to others could not have been satisfied, this was not the field in which his highest enjoyment, or perhaps his highest usefulness, was found. He was by nature intended for a general scholar. His moral and intellectual faculties were all attuned to communion with the sages, philosophers, poets, historians, and thinkers of all ages, assembled around him in his extensive, quiet library, where, far above the rivalries, contests, juggles, and jostlings of professional or political life, well might he say, "My library is dukedom large enough."

He had gathered around him an extensive and choice collection of books, amounting within a few years of his death, and until reduced by the liberal donation to be presently mentioned, to about ten thousand volumes, with the best of which he was familiar, being accustomed not only to constant and careful study, but to taking notes of all that he deemed worthy of especial remembrance. History was one of his favorite studies, and his knowledge of it was extensive and accurate. With that of England and this country he was entirely acquainted; and especially were the records of the lives and doings of the Pilgrim Fathers of New England as familiar to his memory as were the occurrences of his own life. He was highly accomplished in classical lore, and, with his friend, Mr. Pickering, prepared for publication an edition of Sallust, believed to be the first Latin classic edited in this country.

He was thoroughly versed in the theology of the times and its history,— a study which early attracted his attention from the naturally devotional tendency of his nature and the earnest desire ever impelling him to lofty themes of inquiry and contemplation. His fervently devotional spirit, in all the diversified scenes of life, found utterance in the divine music of the Book of books, and the hardly less moving strains of later lyrical inspiration, all familiar to him as household words.

But he was entirely unostentatious of his rich possessions; and no one, from ordinary intercourse with him, would suspect their fulness, excepting as seen in the refinement, purity, elevated moral tone, and serene, comprehensive wisdom pervading his life and conversation, which the highest mental and moral culture can alone produce. He was indeed liberal in communicating his knowledge whenever sought; and earnest in constant efforts to secure as widely as possible for others the blessings of the cultivation which he so well knew how to appreciate. He was a zealous and efficient leader in all enterprises for extending and advancing education and popular instruction; the founder of the Salem Lyceum, when the system of popular lectures was introduced; an earnest and judicious worker in the establishment of the Salem Athenæum, and, with his friend, Dr. Bowditch, chiefly instrumental in procuring for it the means of its present prosperity. He was at the time of his decease the President of the Essex Institute, devoted chiefly to the advancement of the study of natural history, and had a few years previously bestowed upon it about five thousand valuable books from the treasured library which he had been so long and with such pains collecting. For very many years he served as Overseer of the University, fulfilling his duties with active zeal and loving care, and retaining to his last hours a deep interest in all that pertained to her usefulness or glory. He was for a long period one of the most attentive and useful members of this Academy, until advancing age and distance of residence precluded his habitual attendance; and he was selected to pronounce the well-remembered eulogy upon the decease of its President, Mr. Pickering. In fine, he was the uniformly recognized patron and beneficent friend of all benevolent and educational institutions within the scope of his labor or influence.

The intellectual and spiritual elements of Judge White's character are fully illustrated in the chosen occupations of his life. This was peculiarly transparent, illuminated with the mild and genial radiance of mingled wisdom, piety, refinement, benevolence, and love of truth and beauty in all their forms, united with strong affections, and a resolute but gentle firmness of purpose, adding alike to his personal dignity and his efficiency for the good of others. The close of his life was in beautiful accordance with his character and its crowning illustration. Conscious of the near approach of the angel to lead him through the dark valley, he lost none of his usual serene composure and affectionate tenderness to those around him; none of the calm and childlike trust in God and Christ which had guided his daily walks; none of the delight he was accustomed to take in the poetry with which his memory was stored; none even of the genial pleasantry that ever cast its gentle rays upon his social and domestic life. Just before his own departure, that of his friend the Chief Justice was announced to him. "It is in good time," he replied, and soon afterwards a simple, calm prayer, an utterance of unfaltering trust, the repetition of a part of a favorite hymn, and his spirit had taken its flight.

For the purpose, Mr. President, of placing upon our records a humble memorial of our appreciation of their worth and our loss, I submit for the consideration of the Academy the following resolutions:—

Resolved, That in the death of the late Chief Justice Shaw the Academy of Arts and Sciences mourns the departure of one of its most honored and venerated associates, of a great magistrate and good man, whose labors adorned and elevated the jurisprudence of his country, and whose life, devoted to the service of his fellow-men in their highest interests, should ever be held in grateful remembrance.

Resolved, That in the decease of Judge White the Academy recognizes the departure, in a ripe old age, of one of its most venerated members and brightest ornaments, whose eminent Christian virtues and graces adorned society, and whose distinguished scholarship and earnest labors in the causes of learning and charity entitle him to be ranked among the benefactors of the Commonwealth.

Resolved, That we sympathize with the families of our departed associates in the grief which the death of the revered and loved must ever excite, and sympathize with them also in the grateful reflection that, although we may see those whom we thus venerated and loved no more on earth, the influence of their labors and characters can never die.

And that the Secretary be requested to communicate to them copies of these resolutions.

The resolutions were seconded by the Rev. President Walker, who paid an additional tribute to the memory of Judge White. He referred to the collection of distinguished men living in Salem forty years ago, such as was hardly to be met with in any other part of the country, — Bowditch, Story, Pickering, &c., — and of Judge White as one of this select number. Alluding to the present cloud over our public affairs, he spoke of Chief Justice Shaw and Judge White as the product and the representatives of the best days of our country, adding that he could not divest himself of the feeling, that our way is darker and more insecure now that they have fallen asleep.

Also, by the Hon. John C. Gray and Judge Washburn, who illustrated in detail leading traits and particulars in the character and career of the late Chief Justice.

The resolutions were unanimously adopted.

By invitation, after some introductory remarks by Mr. Felton, the Rev. Dr. Cyrus Hamlin, of the Constantinople Mission of the American Board, addressed the Academy upon the subject of Education in European Turkey, and upon the plan and prospects of a collegiate institution about to be established in the vicinity of Constantinople.

Four hundred and ninety-fifth meeting.

May 14, 1861. — MONTHLY MEETING.

The VICE-PRESIDENT in the chair.

The Corresponding Secretary read various letters relative to the exchanges of the Academy with other institutions; and he exhibited the large and invaluable collection of Geological Sections, Maps, Charts, &c. of the Geological Survey of Great Britain, presented to the Academy by the Director of the Survey under the sanction of the British Government.

Professor James Hall, of Albany, made a communication upon some points in North American Geology, in which he proposed and illustrated some novel views in respect to the formation of mountain-chains.

These views were discussed with Professors Agassiz, Rogers, and others.

Four hundred and ninety-sixth meeting.

May 28, 1861. — ANNUAL MEETING.

The VICE-PRESIDENT in the Chair.

The Corresponding Secretary read letters relative to the exchanges of the Academy. He also read, as Secretary of the Council,

The Annual Report of the Council relative to the Personnel of the Academy.

During the past year the Academy has elected four Resident Fellows, four Associate Fellows, and three Foreign Honorary Members.

Three of the Resident Fellows belong to the Third Class, and one to the First Class.

Two of the Associates were elected into the First Class, one into the Second, and one into the Third Class.

Two of the Foreign Honorary Members chosen, viz. **DOVE** and **KÖLLIKER**, fill places vacated in the Second Class. The third, the distinguished and aged **VON RAUCH**, the Nestor of sculptors, who was nominated by the Council a year ago, had deceased some time before the election took place.

From our immediate ranks, three Resident Fellows have been removed by death during the past year; viz. the **REV. DR. HEMAN HUMPHREY**, formerly President of Amherst College, the late **CHIEF JUSTICE SHAW**, and the **HON. DANIEL APPLETON WHITE**, being three of the most venerable members, and all three belonging to the First Section of the Third Class of the Academy.

Dr. Humphrey, who has long held the rank of one of the most distinguished New England divines, was the first President of Amherst College, and he worthily presided over that institution for twenty-two years. Upon retiring from this position, in the year 1845, he resumed his residence at Pittsfield, of the First Church in which place he had formerly been pastor; and here he closed his useful and honorable earthly career, in September last, at the advanced age of eighty-two years. He was elected into the Academy in the year 1842; but, having resided at a great distance from Boston, has rarely, if ever, attended its meetings.

Our loss in the death of the late Chief Justice, and of Judge White, of so recent occurrence, is more immediately and sensibly felt. For in that event the Academy was bereaved, upon the same day, of two of our most experienced and efficient, as well as most venerated members. In the eulogies pronounced at the meeting which immediately ensued, and in the resolves then adopted, this society has so fully expressed its exalted estimation of the character and services of these great and good men, and its deep sense of the loss it has sustained in their removal, that it would be supererogatory for the Council to undertake anew a duty already performed so lately and so well.

We have only to record that the Hon. Lemuel Shaw was chosen a Fellow of the Academy in the year 1823. He was born in Barnstable, on the 9th of January, 1781; he died on the 30th of March last, at the age of eighty years.

Judge White was born five years and two days earlier, viz. on the 7th of January, 1776, in that part of Methuen which is now the city of Lawrence; and he survived for a few hours only his associate and friend. Having been elected in the year 1812, the late Judge White was for almost half a century a Fellow of this Academy, — a length of service which is surpassed by only five surviving members.

Only one Associate Fellow is known to have deceased since the last annual meeting, viz. the Rev. Professor CHARLES B. HADDOCK, formerly of Dartmouth College, New Hampshire, who died on the 15th of January last. He was born in Franklin, then a part of Salisbury, New Hampshire, in the summer of 1796; his father was a trader in that town; his mother was an older sister of Ezekiel and Daniel Webster. He entered Dartmouth College in 1812, was graduated with distinguished honors in 1816, and immediately began the study of theology at Andover. In 1819 he was was chosen to fill the newly established chair of Rhetoric in the College where less than three years before he had taken his first degree; and in 1838 he was translated to the department of Intellectual Philosophy. In 1850 he received from Mr. Fillmore the appointment of *Chargé d'Affaires* at the Court of Portugal, which he held until the year 1855; and, returning to his native

State, he passed the remainder of his life at West Lebanon, in literary pursuits and in the occasional discharge of the duties of the clerical profession. His colleagues at Dartmouth College speak of him as having been an admirable instructor, of rare courtesy and kindness, a discriminating and suggestive critic, with sufficient knowledge and an unusual power of expression. In 1846 he published a volume of Addresses and Miscellaneous Writings, marked by the completeness, the simplicity of style, the good sense, and the pure taste which characterized all his literary productions. His more recent writings, notes of foreign travel, lectures, and discourses, he had begun to prepare for the press, and some of them may yet be published.

Professor Haddock was as urbane and courteous as he was accomplished. He never obtruded himself upon public notice, but it was impossible that he should remain unregarded in whatever community he might reside. One of his maxims, "Do well and wait," he so exemplified in his life, that his friends sometimes wished he were less moderate in his desires, and more strenuous in literary activity. In his position as Minister to Portugal, not indeed one of great responsibility, yet important, he so performed its duties as to make one feel that, if they had been far more delicate and onerous, he would have been quite equal to them.

Two Foreign Honorary Members have deceased during the past year, both German, one of the Second, the other of our Third Class; viz. the venerable and profound anatomist and zoölogist, TIEDEMANN, and the distinguished scholar, BUNSEN.

FRIEDRICH TIEDEMANN died at the age of eighty years, having been born in Cassel in 1781. His father was distinguished as a Professor of Philosophy at Marburg, where the son was graduated in 1804, remaining there as a *privat-docent* until the following year, when he was appointed Professor of Anatomy and Zoölogy at Landshut. In 1816 he was chosen to fill the Professorship of Physiology at Heidelberg, where he remained until 1849, enjoying a distinguished reputation throughout Europe, both for his fidelity as a teacher, and for the merits of his anatomical and physiological investigations. During the political disturbances of 1849, his son, commandant of the fortress at Karlstadt, was shot on account of his sympathies and co-operation with the popular movement, when the father refused any longer to hold an office in the gift of the government. Since then he has lived in retirement, and died in Munich, at the residence of his son-in-law, Bischoff, so distinguished for his embryological investigations.

His published scientific works are numerous, relating to comparative anatomy, to special anatomical studies, to normal development, to monstrosities, and to the physiology of digestion. His investigations on this last subject were made conjointly with Gmelin, who brought in aid his extensive knowledge of chemistry. They studied especially the free acids which are found in the stomach during digestion, and the influence of them on the solution of the food, the changes which take place in the nutritive materials during the passage through the intestines, and the effect of the prevention of the entrance of the bile into the duodenum by the tying of the bile duct. They demonstrated the absorption of fatty substances by the lacteals, and their relation to the color of the chyle; also some of the more important differences between the kind of materials taken up by the lacteals and the veins. On account of the accuracy with which their experiments were performed, and of their having brought both chemistry and anatomical physiology to their aid in conducting them, they have been looked upon, until within a very short time, as of the highest authority on every question connected with the subject of digestion, and Müller commended them as containing all that was positively known with regard to the changes which the chyme undergoes in the small intestines.

Among the anatomical labors of Tiedemann his great work entitled "Tabulæ Arteriarum Corporis Humani" deserves especial mention. It is the most admirable of the works of the kind which have been published. The plates are accurately drawn, of the size of nature, and mostly from recent dissections. This work not only gives a full description of the arterial system as it ordinarily exists, but also the most complete account of the anomalies to which the arteries are liable, and especially the arch of the aorta and its branches. It is not as well known as it should be out of Germany, though it has proved a fruitful resource to those anatomists westward of the Rhine who have written upon the same subject.

In 1821 he published an important work on the brain of monkeys, and those of certain rare mammals which had not been previously described, as compared with the brain of man. This was fully illustrated by plates, very carefully prepared, and great pains were taken to make the proportional measurements of the different parts described precise. Among the more important conclusions which he draws from these examinations are the following; namely, that the cerebral hemispheres of man are larger than those of monkeys when compared with the dimensions of the spinal cord of the cerebellum, medulla oblongata, or optic lobes; that, in the proportions of most of the parts just referred to, the seals, after the monkeys, are among the animals which approach nearest to man; and in the proportions of the brain to the spinal cord are nearer than these, and stand next to man.

His work on the development of the human brain has become classical. This was the result of patient labor, extending through several years, and has for its object a complete description, from his own dissections, of the changes which the brain undergoes from early fœtal life to the end of gestation. The gradual evolution of parts is described for each month of intro-uterine life. In addition to the developmental phases which the brain presents under such circumstances, he has given a comparative exposition of its structure in the different classes of vertebrates, in order to show how far the formation of this organ in the human fœtus goes through, in different embryonic periods, stages which correspond with, or resemble, the mature brains of the lower animals. These resemblances, which had been partially recognized by Meckel, were far more satisfactorily demonstrated and illustrated by Tiedemann. This work was published in 1816, and treats of a subject then new to physiological science; and out of Germany the ideas which it taught were generally received with ridicule by the physiologists of his time. To-day they are almost universally adopted. Better microscopes, and a more extensive use of them than was possible in his time, have added much to our knowledge of the development of the brain. No one work relating to the same subject presents better results than those contained in his monograph, and to this day it is the best authority.

In 1836 he presented to the Royal Society a memoir on the brain of the Negro compared with that of the European and the Orang-outang. In this he discusses the question, whether there is any essential difference between the brain of the Negro and that of the European, and whether the former resembles that of the Orang more closely than the brain of the European does. His desire to substantiate everything by the accumulation of facts is conspicuous in this memoir. His results are based upon a comparison of the weights of more than fifty brains, and the measurement of the internal capacity of two hundred and sixty-eight crania of different nations. From the data drawn from these sources, he concludes that, although the Negro brain in some respects (as, for example, in its breadth as compared with its length, as also, to a slight extent, as regards its size and weight) is inferior to that of the European, in most others it is not so, and that the difference between the brain of the Negro and that of the Orang is far greater than between the former and the European. He concludes his memoir with a general survey of the contributions of Negroes to literature and science, and expresses full confidence in their capacity for progress in civilization, and believes that, but for the depressing influence of the African slave-trade, this capacity might soon become manifest.

He commenced a "Complete Treatise on Human Physiology," but this was never finished. The first two volumes, which are merely introductory, are remarkable for their broad and philosophical views, and are based upon a very extensive knowledge of comparative anatomy and physiology. The importance of these last sciences to the progress of human physiology no one more fully appreciated than he. Among other monographs published by him, those on the following subjects may be mentioned: —

On the Nerves of the Uterus.

On the Ophthalmic Ganglion and the Ciliary Nerves of Animals.

On the Comparative Anatomy of the Hearts of Fishes.

On the Anatomy of Anencephalous and Acephalous Monsters.

This last is a very complete monograph, and comprises the results of very numerous dissections.

His monograph on the structure of the Echinoderms was one of his most celebrated works, and received the prize of the French Institute in 1811. It was not published until 1816.

In forming an estimate of the value of Tiedemann's labors, we must not judge him by the standard of the present day. It is nearly twenty years since his period of activity ended, and in the mean while physiology has undergone a complete revolution. When he was retiring from the field of active life, the importance of the test-tube, the balance, and the microscope were only beginning to be appreciated. Liebig had just commenced his researches in physiological chemistry, and histological discoveries had only begun to influence the scientific world. Nevertheless, we are very largely indebted to him for the impulse which, during the last thirty years, has advanced physiology to the rank which it now holds among the sciences. Tiedemann's influence is to be attributed quite as much to the spirit which he brought to his inquiries, and the thoroughness of his teaching, as to his actual contributions to the progress of science, though these have always been acknowledged as of great importance. With a mind eminently qualified for the work by an extensive knowledge of natural history and comparative anatomy, as well as by methodical and careful habits of investigation, he devoted himself earnestly and truthfully to the advancement of his science. Animated by the spirit of an aphorism of Bacon's, which he uses as a motto for one of his own works, "Non fingendum aut excogitandum, sed quid natura faciat observandum," he labored to bring everything to the test of direct observation and experiment.

CHRISTIAN CHARLES JOSIAS (BARON) BUNSEN died at Bonn on the 28th of November, 1860, aged sixty-nine years.

The key-note to Bunsen's literary life is struck in a single sentence in one of Dr. Arnold's letters: "I find in you that exact combination of tastes which I have in myself, for philological, historical, and philosophical pursuits, centring in moral and spiritual truths." In philology he sought to work his way up to the auroral life of mankind. Believing that language is in itself the most ancient and most certain record of the human race, and firmly persuaded of the unity of the race, he valued the remains of early speech as the oldest testimony to mental development, and studied them as great historical facts. In them he hoped to find a clew to the moral and spiritual formation of society. The reconstruction of the history of language would, as he conceived, furnish a scaffolding for the primeval history of religion. With these views, he welcomed every new round in the ladder, as it was fixed or supposed to be fixed by himself or his younger friends, and in his work on Egypt dwelt with peculiar satisfaction on the intermediate, but not unconnected, position which he thought was established for the language of that country, between the Semitic and Indo-Germanic families; thus bringing together the two great factors of modern civilization, which have supplied the chief elements of his favorite study, the philosophy of universal history.

Philology, philosophy, and theology were thus cemented in his mind. To him the cardinal truth of historical philosophy was the final victory of the divine principle of truth and justice. He saw in the past a sure movement in that direction, and had no doubt that the future would carry it through. Thus his method was professedly historical. With the *un*historical spirit, of which he saw about him the evils and the dangers, he had no patience. "Christianity," he said, "stands or falls with the person of Christ as represented in the Gospels." Believing that the Christian religion had begun a new world, he warmly assailed whatever in the past or present appeared to clog its appointed work. He glorified the memory of the German Reformers, whom he honored as the regenerators of modern society. In this sense at least he was the most Protestant of Protestants. A revelation of God's will and truth he found not less in the providential advance of order and virtue, than in the Bible itself. He sought to unite the two revelations, and to express in broad generality the lessons of Scripture under the form of a philosophy of development. He calls the Bible "the mirror of universal history." With destructive rationalism, as such, he had no sympathy. Indeed, reconstruction seems to have been the dream of his life. He saw with sorrow the signs of a waning and setting faith around him. But he thought he also saw a deep and wide-spread yearning for a better light. To open the way to that was his cherished wish. His "Bibelwerk," as he himself explicitly declared, was undertaken in that spirit. Under this impulse, also, he strove to pierce through what he deemed the inventions of synods and councils, into the simple beliefs of the Apostolic age. And in the same temper he speculated hopefully on the Church of the Future. This may serve for a meagre sketch of his philosophy. It belongs to the theologian to decide on the value of his researches and theories. If some of his expressions are wanting in sharpness of boundary, and seem to play about the mind rather than to enter it, it is but just to their author to add his declaration, that his system forms in his own mind a connected whole. Dr. Arnold once wrote to him in reference to a theological point: "I believe that you have got hold of a truth which is as yet to me dark; just as I cannot understand music, yet nothing doubt that it is my fault, and not that of music." This is a modest and friendly expression of a real difficulty.

Bunsen has said that "Restoration, both in a philosophical and an historical sense, is the problem of the present day." His characteristic traits come out in his attempts at restoration. Reconstruction is always a delicate, often a slippery work. It involves a certain ratio of destruction, and it offers a tempting stage for the exhibition of favorite theories. To strike the exact proportion between what is to be saved and what thrown away, and to be duly jealous of one's own idols, is a hard trial to that sanguine cast of intellect which is almost indispensable to the idea of restoration. Bunsen was undoubtedly sanguine. His language glows with the warmth of his convictions and the ardor of his hopes. It is even as strong as this: "The chronological dates which we deduce from Egyptian research render it necessary to remodel history, and enable us to remodel it." And surely a more honorable instance of steadfast industry can hardly be named in our day than his attempt to accomplish this. The title of his great work, "Egypt's Place in Universal History," bears witness to the wide range of his purpose and wish, and its execution is a monument of hopeful study. In restoring ancient chronology he knew the extreme difficulty of the task he undertook. He is very positive in his conclusions, though many of them are contested by able scholars. Egyptologers must fix Bunsen's place in their science. They can perhaps tell us how many degrees of Egyptian darkness he has cleared off. What is here said merely aims to point out his purpose and connect it with the great objects of his life.

Though Bunsen's apothegms and theses are not always transparent, at least to a common reader, he was not a man to deal in vague and sounding phrases that found no echo in his own heart. So far from this, it is impossible for his reader, even when a little doubtful of his meaning, to have the shadow of a doubt as to his zealous, hearty, and liberal spirit. Whoever approaches him, whether he agrees with the thinker or not, must respect the man. He was a stanch and fearless friend of liberal institutions in church and state, and found the warrant for them in the Christian religion itself. He rejoiced in the growing importance of the middle class in his own country, and made it his boast to have sprung from it himself. If in controversy his polemic zeal fell sometimes heavy on an opponent, it was not in any poor or grovelling cause. Materialism and despotism he hated with all his soul. He had the eye to recognize and the force to stimulate the studies and efforts of others, and his death snaps one of the last links between men of the past, like Heyne, Niebuhr, and Arndt, and younger scholars, like Lepsius and Max Müller, whose co-operation he gladly sought and fairly acknowledged. His long residence at the Court of St. James's, the last of a line of diplomatic distinctions, naturalized him in the English language and in English society; and it was enriched with the cordial regard of such men as Arnold, Hare, and Kingsley. In all the variety of his active toils, whether in spinning again the thread of ancient history, in denouncing ecclesiastical intolerance, or in gathering up the hymns of the Church, we meet a man who clung to his belief in progress, and knew no synonyme for selfishness but sin.

A more noble and dignified retirement than that of his last years it would be difficult for a public servant to find. For a while out of favor at court, he withdrew to a beautiful home on the banks of the Neckar, where he lived in his family and surrounded by his books and other friends. Any one who has passed a day under that hospitable roof will not soon forget the kindly greeting of the benevolent and venerable man. Honors returned to him in due time, and he removed to the seat of that University which had heard the last teachings of his early friend and patron, Niebuhr. He lived long enough to witness the breaking away over Italy of that cloud which had nearly filled him with despair. And when death came upon him, it found him cheerful and ready. With higher names, the name of Niebuhr lingered on his lips, and now he sleeps beside him. The words he wrote for Arnold's epitaph might well come back to furnish his own: "Strenuus, unice dilectus, populi Christiani libertatem vindicavit."

At present the Academy consists of 156 Resident Fellows, of which the First Class contains 48; the Second Class, 48; the Third Class, 60. The proportions in the sections remain nearly unchanged from last year, except that the section of Philosophy and Jurisprudence, which was before the smallest of the Third Class, is reduced from *thirteen* to *ten* members.

There are 81 Associate Fellows, of which the First Class contains 35; the Second Class, 30; the Third Class, 16.

The actual Foreign Honorary Members are 71; of the First Class, 27; the Second Class, 27; the Third Class, 17.

The Treasurer submitted his Annual Report, which was ordered to be entered in full upon the records.

Professor Lovering read the Report of the Committee on Publication, and Dr. A. A. Gould that of the Library Committee.

Appropriations were voted, on motion of the Treasurer, of $ 800 for the Library, $ 1,100 for general expenses, and $ 1,400 for publications for the ensuing year. On motion of Mr. Emerson, a special appropriation of $ 400 was voted for the continuation of Dr. Storer's Report on the Fishes of Massachusetts.

Rev. Professor Andrew P. Peabody of Cambridge was elected a Fellow, in Class III. Section 4.

William Ferrel of Cambridge was elected a Fellow, in Class I. Section 1.

At the election, the officers of the preceding year were re-chosen by ballot; and the members of the several standing committees were re-appointed by the chair.

DONATIONS TO THE LIBRARY,

FROM MAY 29, 1860, TO MAY 28, 1861.

American Philosophical Society.

Transactions. New Series. Vol. XI. Part III. 4to. Philadelphia. 1860.

Proceedings. Vol. VII. Jan. 1859 to Jan. 1861. 8vo. Philadelphia. 1861.

Laws and Regulations and List of Members. 8vo pamph. Philadelphia. 1860.

Academy of Natural Sciences, Philadelphia.

Journal. N. S. Vol. IV. Part IV. 4to. Philadelphia. 1860.

Proceedings. Vol. XII. pp. 97 – 144; 361 – 476; 517 to end of vol. 8vo. Philadelphia. 1860.

A Notice of the Origin, Progress, and Present Condition of the Academy of Natural Sciences of Philadelphia. By W. S. W. Ruschenberger, M. D. 2d Ed. 8vo. pamph. Philadelphia. 1860.

American Antiquarian Society.

Proceedings in Boston, April 25, 1860; — in Worcester, Oct. 22, 1860; — in Boston, April 24, 1861. 8vo. 3 pamph. Boston. 1860 – 61.

Archæologia Americana. Transactions and Collections of the American Antiquarian Society. Vol. IV. 8vo. Boston. 1860.

Hon. Henry Wilson.

Message and accompanying Documents. Vol. I. 8vo. Washington. 1860.

Chicago Historical Society.

Transactions of the Illinois State Agricultural Society, with Notices and Proceedings of County Societies and kindred Associations. Vols. II. and III. 1856 – 58. 8vo. Springfield. 1857 – 59.

Second Biennial Report of the Superintendent of Public Instruction of the State of Illinois, for the Years 1857–1858. 1 vol. 8vo. Springfield. 1859.

Report of the Water Commissioners of the City of Chicago, made to the Common Council, Dec. 8, 1851; together with an Act of Incorporation, and a Statement of the Financial Condition of the City, Nov. 10, 1851. 8vo pamph. Chicago. 1851.

City Comptroller's Third Annual Statement of the Receipts and Expenditures of the City of Chicago, for the Financial Year 1859–60. 8vo pamph. Chicago. 1860.

Eleventh Semi-Annual Report of the Board of Water Commissioners to the Common Council of the City of Chicago, Jan. 1st, 1857. 8vo pamph. Chicago. 1857.

Report and Plan of Sewerage for the City of Chicago, Illinois, adopted by the Board of Sewerage Commissioners, Dec. 31, 1855. 8vo pamph. Chicago. 1855.

Report of the Board of Sewerage Commissioners of the City of Chicago, for the Half-year ending June 30, 1860. 8vo pamph. Chicago. 1860.

Chicago Sewerage. Report of the Results of Examinations made in Relation to Sewerage in several European Cities, in the Winter of 1856–57. By the Chief Engineer of the Board of Sewerage Commissioners. 8vo pamph. Chicago, Ill. 1858.

Second Annual Statement of the Trade and Commerce of Chicago, for the Year ending Dec. 31, 1859. By Seth Catlin, Secretary. 8vo pamph. Chicago. 1860.

Rights of Congregationalists in Knox College: being the Report of a Committee of Investigation of the General Association of Illinois; with an Appendix. 8vo pamph. Chicago. 1859.

Proceedings of the Fourteenth Annual Meeting of the American Institute of Homœopathy, held in Chicago, Wednesday, June 3, 1857. 8vo pamph. Chicago. 1857.

Geological Society, Dublin.

Journal. Vols. III., V., VI. Part II., VII. Parts I. and IV., VIII. Part II. 8vo. Dublin. 1844–59.

Experimental Researches on the Granites of Ireland. By Rev. Samuel Haughton, M. A., F. G. S., etc. [From Quart. Jour. of the Geol. Soc. for Aug. 1858.] 8vo pamph.

On some Rocks and Minerals from Central India, including two new Species, Hislopite and Hunterite. By Rev. Samuel Haughton.

. . . . . [From the Phil. Mag. for Jan., 1859.] 8vo pamph. Dublin.

On the Iron Ores of Carnarvonshire. By Rev. Samuel Haughton. [From Jour. of Geol. Soc. of Dublin, Vol. VI. Part II.] 8vo pamph. Dublin. 1854.

On the Lower Carboniferous Beds of the Peninsula of Hook, County of Wexford. By Rev. Samuel Haughton. . . . . . 8vo pamph.

On the Black Mica of the Granite of Leinster and Donegal; and its probable Identity with Lepidomelane. By Rev. Samuel Haughton. . . . . . [From Quart. Jour. of Geol. Soc. for Feb. 1859.] 8vo pamph.

On the Felspar and Mica of the Granite of Canton. By Rev. Samuel Haughton. . . . . . [From Phil. Mag., April, 1859.] 8vo pamph. Dublin. 1859.

On Serpentines and Soapstones. By Rev. Samuel Haughton. . . . . . [From Phil. Mag. for Oct. 1855.] 8vo pamph. Dublin.

Imperial Society of Natural Sciences, Cherbourg.

Mémoires. Tom. VI. et VII. 8vo. Paris et Cherbourg. 1859 – 60.

Imperial Academy of Sciences, etc., Dijon.

Mémoires. Deux. Serie. Tom. VII. 1858 – 59. 8vo. Dijon. 1859.

Imperial Academy of Sciences, etc., Caen.

Mémoires. 1 vol. 8vo. Caen. 1860.

Alexis Perrey.

Note sur les Tremblements de Terre en 1856, avec Supplements pour les Années Anterieures. 8vo pamph. Dijon. 1858.

Académie des Sciences de l'Institut Impériale de France.

Mémoires. Tom. XXV.; XXVII. 2^{me} Pt.; XXXI. 1re et 2^{me} Pts. 4to. Paris. 1860.

Mémoires presentes par divers Savants. . . . . . Sc. Math. Tom. XV. 4to. Paris. 1860.

Comptes Rendus. Tom. XLIV. Nos. 1, 2, et Table des Matières; XLVII. Nos. 25 et 26; XLIX. Tables des Matières; L. Nos. 8, 9, 15 – 17, 19 – 26; LI.; LII. Nos. 1 – 17. 4to. Paris. 1859 – 61.

Séances et Travaux de l'Académie des Sciences Morales et Politiques. 3^{e} Série. Tom. XXX. 10^{e} Livr. Oct. 1859. 8vo. Paris.

Société de Physique et d'Historie Naturelle de Genève.

Mémoires. Tom. XXV. 4to. Genève. 1860.

Société Imperiale Zoölogique d'Acclimatation.

Bulletin. Tom. III. Nos. 1, 3 – 12; V. No. 12; VI. Nos. 7 – 9; VII. Nos. 1, 2, 4 – 10, 12; VIII. No. 3. 8vo. Paris. 1856 – 61.

Royal Prussian Academy.

Abhandlungen. Jahr. 1858 und 1859. 4to. Berlin. 1858 – 59. 1854 Zweiter Suppl. Band.

Monatsbericht. Jahr. 1859. 8vo. Berlin. 1859.

Imperial Academy of Sciences, Vienna.

Denkschriften. Math.-Natur. Classe. Band. XVI., XVII., XVIII. — Phil.-Hist. Classe. Band. IX und X. 4to. Wien. 1859 – 60.

Sitzungsberichte. Phil-Hist. Classe. Band. XXX., XXXI. Heft. 1 – 3; XXXII. Heft 1; XXXIII., XXXIV., XXXV., Heft. 1 und 2; Register zu den Bänden 21 bis 30. — Math.-Natur. Classe. Band. XXXVII., XXXIX., XL., XLI., XLII. No. 21; Register zu den Bänden 21 bis 30. 8vo. Wien. 1859 – 60.

Almanach der Kais. Akad. der Wissen. 9 und 10 Jahr. 16mo. Wien. 1859 – 60.

Jahrbucher der K. K. Central-Anstalt zür Meteorologie und Erdmagnetismus von Karl Kriel. Band VI. Jahr. 1854. 4to. Wien. 1859.

Batavian Society of Arts and Sciences.

Acta Societatis Scientiarum Indo-Neerlandicæ. Vols. I. – IV. 4to. Batavia. 1856 – 58.

Natuurkundig Tijdschrift voor Nederl. Indie. Deel IV. – XVIII., XX. 8vo. Batavia. 1853 – 60.

Natural-History Society of the Prussian Rhineland and Westphalia.

Verhandlungen. XVI. Jahr. 8vo. Bonn. 1859.

University of Bonn.

Index Scholarum quæ in Universitate Frid. Guil. Rhen. 1859 a die II. Mai, publice privatimque habebuntur. — Præcedunt Porcii Licini de Vita Terentii Versus Integritati Restituti. 4to pamph. Bonnæ. 1858.

Index Scholarum, etc. 1859 et 60 a die XV. Octobris, etc. — Præcedit Disputatio de Poetarum Testimoniis quæ sunt in Vita Terentii Suetonia. 4to pamph. Bonnæ. 1859.

Indicia Quinque Ordinum Univ. Frid. Guil. Rhen. de Litterarum Certaminibus Anni 1858 – 1859 facta novæque Quæstiones 1858 – 1860 propositæ. 4to pamph. Bonnæ. 1858.

Vorlesungen auf der Rheinischen Friedrich-Wilhelms-Universität zu Bonn im Sommerhalbjahr 1859. — Vorlesungen im Winterhalbjahr 1859–60. 2 pamph. 4to. Bonnæ. 1859.

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Translation of the Sûrya-Siddhânta, a Text-Book of Hindu Astronomy; with Notes, and an Appendix, containing Additional Notes and Tables, Calculations of Eclipses, a Stellar Map, and Indexes. By Rev. Ebenezer Burgess, formerly Missionary of the A. B. C. F. M. in India; assisted by the Committee of Publication of the American Oriental Society. [From the Jour. of the Am. Or. Soc., Vol. VI., 1860.]

J. B. Trask, M. D.

Contributions to the Anatomy of the Spinal Cord. 8vo pamph. San Francisco, California. 1860.

Richard F. Bond.

Description of Bond's Isodynamic Escapement for Astronomical Clocks. [From "Brunnow's Astron. Notices," Oct. 1860.] 8vo pamph. Boston. 1860.

Felix Flugel, Ph. D.

Bulletin de la Société Paleontologique de Belgique, Fondée a Anvers, le 1er Mai, 1858. Tom. I. Feuilles, Nos. 1 à 5. 8vo pamph. Anvers. 1859.

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Achthundert und Zwanzig neue oder unbeschriebene Wirbellose Thiere charakterisirt von Doctor Johannes Gistel. 8vo pamph. Straubing. 1857.

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Prof. Arnold Guyot.

Carl Ritter: an Address to the American Geographical and Statistical Society. 8vo pamph. Princeton, N. J.

Harvard College.

Report of the Committee of the Overseers of Harvard College appointed to visit the Library for the Year 1861. 8vo pamph. Boston. 1861.

Josiah Curtis, M. D.

Eighteenth Report to the Legislature of Massachusetts relating to the Registry and Return of Births, Marriages, and Deaths in the Commonwealth, for the Year ending December 31, 1859. By Oliver Warner, Secretary of the Commonwealth. 8vo pamph. Boston. 1861.

Joel Parker.

An Address before the Citizens of Cambridge, Oct. 1, 1856, on Non-Extension of Slavery and Constitutional Representation. 8vo pamph. Cambridge. 1856.

Personal Liberty Laws (Statutes of Mass.), and Slavery in the Territories (Case of Dred Scott). 8vo pamph. Boston. 1861.

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Notices of the Proceedings at the Meetings of the Members. Vol. III. Part 10. Nov. 1859 – July, 1860. 8vo. London. 1860.

List of the Members, Officers, &c. for the Year 1859. 8vo. London. 1860.

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Radcliffe Catalogue of 6317 Stars, chiefly Circumpolar, reduced to the Epoch 1845.0; formed from the Observations made at the Radcliffe Observatory, under the Superintendence of Manuel John Johnson, M. D., late Radcliffe Observer; — with Introduction by Rev. Robert Main, M. A., Radcliffe Observer. 1 vol. Roy. 8vo. Oxford. 1860.

Four hundred and ninety-seventh meeting.

August 14, 1861. — STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters relative to the exchanges of the Academy; also letters from the Rev. Professor Peabody and Mr. Ferrel, in acknowledgment of the official notification that they had been chosen Fellows of the Academy, and from the family of the late Chief Justice Shaw, and from that of the late Judge White, in acknowledgment of the reception of copies of the resolves of the Academy adopted upon the occasion of the announcement of their decease.

A quorum for the transaction of business not being present, scientific communications only were received.

Dr. Beck gave an account of the principal manuscript copies of the *Satyricon* of Petronius Arbiter preserved in various European libraries, and which he had examined; and he presented to the Academy a collation of the various readings of these manuscripts, with a view to the construction of an amended text of this author.

The Corresponding Secretary communicated, from the author, the following paper: —

Musci Cubenses, or Mosses collected by Charles Wright in the Eastern Part of the Island of Cuba during the Years 1856, 1857, *and* 1858. By WILLIAM S. SULLIVANT.

Gen. SPHAGNUM, *Dill.*

1. S. CYMBIFOLIUM, *Ehr.; Sch. Nat. Hist. Sphaig. p.* 73, *t.* 19. — Wet places on the tops of high mountains. — Specimens without fruit: the cortical utricles of the branches often destitute of fibres.

Gen. POTTIA, *Ehr.*

2. P. TORTULA, *C. Mull. Synop. Musc.* 1, *p.* 559; *Schwægr. Suppl. t.* 175. — On rocks.

3. P. BARBULA, *C. Mull. l. c. p.* 558; *Schwægr. Suppl. l. c.* — On rocks along mountain rivulets. — Remains of a peristome resembling that of *Barbula* were found on some of the specimens.

Gen. WEISSIA, *Hedw.*

4. W. EDENTULA (*sp. nov.*): dioica, capsula oblonga gymnostoma exannulata, cæterum *W. crispatæ* simillima. — On the ground in shady thickets.

5. W. VIRIDULA, *Brid.; Bryol. Europ. t.* 21 & 22. — On banks by road-sides.

Gen. PHYSCOMITRIUM, *Brid.*

6. P. SPATHULATUM, *C. Mull. Synop. Musc.* 1, *p.* 118? — Wet places by road-sides in woods.

Gen. GYMNOSTOMUM, *Hedw.*

7. G. IMMERSUM, *Sulliv. Icones Muscorum, ined. t.* 56. — Moist places along shaded roads.

8. G. RUPESTRE, *Schwægr.*, var. statura majore, cæspite laxa, foliis lineari-lanceolatis acutis: forsan species propria. — On steep, shaded banks, along rivulets.

Gen. FUNARIA, *Schreb.*

9. F. HYGROMETRICA, *Hedw.; Bryol. Europ. t.* 305. — On the ground; common.

Gen. FISSIDENS, *Hedw.*

10. F. POLYPODIOIDES, *Hedw. Musc. frond.* 3, *p.* 63, *t.* 27. — On banks in dense woods.

11. F. MINUTULUS, *Sulliv. in Mem. Amer. Acad. n. ser.* 3, *p.* 58, *t.* 2; *Icones Musc. ined. t.* 24. — On calcareous banks in thickets.

12. F. MINUTULUS, var. foliis latioribus, capsula inclinata. — Same locality.

13. F. SIMILIRETIS (*sp. nov.*): dioicus exiguus simplex; caule rigido inferne nudo; foliis 20–30-jugis confertissimis subhomomallis linearibus acutis minute subopace guttulato-areolatis toto ambitu immarginatis minutissime crenulato-serrulatis, duplicatura ⅔ producta, lamina dorsali angusta ad basin vel supra desinente, costa valida pellucida flexuosa sub apice dissoluta; capsula terminali brevius pedicellata oblongo-obovata; operculo et calyptra desideratis. — On cliffs among mountains. — A larger species than the last: fronds 4–5 lines high and about one line wide, pale olive-green above and reddish-brown below: leaves not crisped when dry.

14. F. DISSITIFOLIUS (*sp. nov.*): dioicus simplex erectus mollis remoti-folius; foliis elongato-oblongis lineari-oblongisve breviter acutis fere ad apicem subdenticulatam anguste marginatis, lamina dorsali lata ad basin sensim vel abrupte desinente, e cellulis laxis amplis hexagono-rotundatis (illis duplicaturæ basilaribus oblongis amplioribus) areolatis, costa infra apicem evanescente; capsula terminali ovali-oblonga; operculo longirostrato; calyptra dimidiata. — Wet rocks in shaded ravines. — Somewhat larger than the last species, with distant, dark green, and when dry crisped leaves.

15. F. DENSIRETIS (*sp. nov.*): dioicus parvus gracilis simplex rigidus; foliis 20–25-jugis confertis subsecundis linearibus sensim acutatis minutissime crenulato-serrulatis opacis ad apicem usque pellucido-costatis, lamina duplicaturæ ½ producta limboque pellucido intromarginali instructa, lamina dorsali apicalique immarginatis; capsula terminali brevius pedicellata obovato-oblonga; operculo longirostrato; calyptra dimidiata. — On the bottom of dried-up rivulets. — Fronds slender, 5–8 lines high, gradually increasing in width from the base upwards, but nowhere more than about half a line wide: leaves dark green, opaque, with very minute cells, remarkable for the band composed of three rows of pellucid, linear cells, just within the margin of the duplicature.

16. F. CUSPIDULATUS (*sp. nov.*): dioicus pusillus simplex gracilis; foliis 16–20-jugis elongato-oblongis obtusiusculis costa pellucida excedente cuspidulatis opacis crenulato-serrulatis minutissime guttulato-areolatis, lamina duplicaturæ ⅔–¾ productæ hyalino-marginata, lamina apicali et dorsali ad basin late rotundata immarginatis; capsula termi-

nali oblonga; operculo et calyptra precedentis. — On rocks in ravines. — Fronds slender, 4 – 5 lines high, dark olive-green. Near *F. Ravenelii*, but a taller plant with more oblong leaves, their dorsal lamina broad and obtuse at the base.

17. F. RUFULUS (*sp. nov.*): synoicus perparvulus simplex; foliis 5 – 7-jugis lanceolato-linearibus sensim acutis rufulis integerrimis immarginatis, e cellulis majusculis hexagono-rotundatis pellucidis areolatis, duplicatura ½ producta apice inæquali, lamina dorsali latiuscula ad basin abrupte desinente, costa concolori percurrente; capsula breviter pedicellata ovali-oblonga; calyptra conica longum operculi rostrum solum tegente. — On reddish earth, attached to the roots of trees uptorn by wind. — A minute species, 1 – 2 lines high, of a pale brownish-red color: agrees in many respects with the description of a Surinam species, *F. pellucidus, Hornsch. in Linnæa*, 1841, *p.* 146, but the leaves are of a firm texture, and the areolation, though large, not splachnoid; furthermore, the inflorescence is synoicous, which is not asserted of the Surinam plant.

18. F. ANGUSTIFOLIUS (*sp. nov.*): dioicus pusillus conferte flabellatim foliosus; foliis linearibus angustissimis longissimis acutis circumcirca marginatis integerrimis densius pellucido-hexagono-areolatis, duplicatura ½ producta, lamina dorsali ad basin desinente, costa cum apice dissoluta; capsula terminali ovali-oblonga seu oblongo-obovata; operculo capsulam excedente; calyptra dimidiata operculum vix tegente. — Wet places on the ground in dense wooods. — Fronds 1 – 2 lines high and nearly as wide. Leaves bright green, crisped when dry, short below, rapidly increasing in length as they ascend. Pedicels 4 – 5 lines high.

19. F. SPHAGNIFOLIUS (*sp. nov.*): dioicus pusillus; fronde declinata; foliis flaccidis 5 – 9-jugis confertis flabellatim expansis longe lineari-lanceolatis integerrimis hic illic submarginatis, cellulis amplissimis subrhombeis flexuose circumscriptis utriculo primordiali valde evoluto, duplicatura inæquali vix ½ producta, costa longe infra apicem dissoluta; capsula terminali in pedicello geniculato-ascendente inæquali-oblonga incurva; operculo longe rostrato calyptram lineari-conicam excedente. — Found growing with No. 17. — Fronds similar in size and outline to those of No 18; pedicels longer.

20. F. CLAVIPES (*sp. nov.*): dioicus perpusillus simplex vel parce ramosus laxifolius; foliis 8 – 10-jugis lineari-lanceolatis ubique densius pellucide rotundato-areolatis basi duplicaturæ ½ productæ laxius oblongo-

areolata excepta, lamina dorsali ad basin sensim evanescente, marginibus omnibus limbo angusto integro e cellulis linearibus constructo circumcinctis, costa cum apice evanida; capsula terminali ovali-oblonga, pedicello apice incrassato; operculo longirostrato; calyptra dimidiata. — Wet banks of rivulets. — A very small species, remarkable for the apophysate appearance of its capsule, owing to a thickening of the upper part of the pedicel. Stems 2–3 lines high, with bright-green foliage, crisped when dry.

21. F. PETROPHILUS (*sp. nov.*): monoicus rigidus gracilis, basi nudiuscula fasciculatus, prolifero-elongatus; foliis circiter 30-jugis confertissimis erectis longissimis angustis e basi ad apicem sensim acuminatis, duplicatura inæquali ⅔ et ultra producta, lamina dorsali angusta supra basin sensim evanescente, cellulis firmis pellucidis flavidis subrotundis illis secus costam sub apice evanidam majoribus; capsula terminali inæquali-oblonga subinclinata brevipedicellata; operculo et calyptra precedentis. — On rocks in ravines. — Fronds 8–10 lines high, slender, gradually increasing in width towards the top, where they are nearly one line wide. Foliage of a firm texture, dark green dashed with light brown, not crisped when dry.

Gen. TREMATODON, *Rich.*

22. T. LONGICOLLIS, *Rich.; Schwægr. Suppl. t.* 126. — On banks, rare.

Gen. TRICHOSTOMUM, *Hedw.*

23. T. CANALICULATUM, *Hampe.* — Same as a Venezuelan specimen from Hampe: where described? — On the rocky banks of streams.

24. T. MACROSTEGIUM (*sp. nov.*): dioicum gregarium; caule simplici brevi gracili; foliis e basi pellucide ampliuscule areolata longa vaginante superne latiore undulata erecto-patentibus ovato-acuminatis vel lanceolatis, perichætialibus longioribus margine flexuoso-involutis, omnibus superne dense quadrato-areolatis apice plus minus serratis, costa percurrente; capsula anguste cylindracea curvula inclinata; operculo longissime aciculari capsulam superante; perist. dentibus longis leniter contortis atropurpureis papillosis filiscenti-attenuatis. — On rocky banks. — The distinguishing characters of this species are, the sheathing base of its leaves, particularly the perichætial, the remarkably long operculum, exceeding in length the slender, cylindrical, inclined, and often horizontal capsule, and the finely attenuated apices of the teeth of the peristome.

25. T. INVOLUTUM (*sp. nov.*): dioicum dense cæspitans caule subsimplici densifolioso; foliis lineari-lanceolatis e basi brevi erecta horizontali-recurvis involuto-concavis marginibus angustissime inflexis, costa cum apice evanida; capsula cylindracea in pedicello breviusculo erecta; operculo conico-rostrato; perist. dentibus brevissimis erectis plus minus irregularibus bifidis vel pertusis. — On rocky ground. — Stems thick, 3 – 4 lines high; pedicels about the same height; foliage very dark green. The main characters of this species are, the imperfect peristome, and the strong involution of the leaf, which, when flattened, is of a broad elongato-lanceolate outline.

26. T. INVOLUTUM, var. statura minore, foliis fusco-flavescentibus minus divergentibus. — In similar localities.

Gen. BARBULA, *Hedw.*

27. B. GRACILIS, *Schwægr.; Bryol. Europ. t.* 145. — On wet, rocky banks.

28. B. AGRARIA, *Swartz; Doz. et Molkb. Prod. Bryol. Surinam. p.* 15, *t.* 8. — Rocks, and dry, sandy places; common.

29. B. LINEARIS, *Swartz; Schwægr. Suppl. t.* 30. — Moist, rocky ledges.

30. B. CRUGERI, *Sond.; Mull. Synop.* 1, *p.* 618. — Banks of earth in coffee-fields.

31. B. OBSCURA (*sp. nov.*): dioica; cæspite arctius cohærente; caule gracili fastigiato-ramoso laxifolioso; foliis recurvo-patentibus e basi oblonga sensim longe lineari-acuminatis ad apicem costatis subtortilibus; capsula elongato-cylindracea curvula; operculo conico-subulato. — Dry banks. — Near *B. gracilis*, but has less crowded and more spreading leaves, not tapering so suddenly from the base, nor reflexed on the margins. The capsule is longer and slightly curved.

32. B. SUBULIFOLIA (*sp. nov.*): dioica laxe cæspitans; caulibus gracilibus erectis dichotome ramosis; foliis laxis erecto-patentibus strictis e basi ovato-lanceolata sensim in subulam longam costa valida fere impletam productis; capsula cylindracea erecta; operculo aciculari. — Wet rocks, along mountain rivulets. — Resembles *B. campylocarpa*, *Tayl.*, but has a straight and shorter capsule, and leaves with a more predominant costa.

33. B. MNIIFOLIA (*sp. nov.*): dioica laxe cæspitosa; caule humili; foliis laxis mollibus patulis pellucidis e basi oblonga carinato-concava

lingulato-spathulatis inferne oblongo-, superne hexagono-, amplissime areolatis anguste marginatis, costa apicem vix attingente; capsula cylindracea erecta; operculo conico-lineari obtuso. — Dry, shaded banks. — Stems 3-4 lines, pedicels 7-8 lines high. The foliage much resembles that of *Mnium punctatum*.

Gen. DICRANUM, *Hedw.*

34. D. DEBILE, *Hook. et Wils.; Sulliv. Icon. Musc. ined. t.* 20. — Ground, wet places.

35. D. ALBULUM (*sp. nov.*): dioicum albido-viride tenerum laxe cæspitans flexuoso-erectum; ramis incurvis; foliis pellucidis confertis homomallis subfalcatis anguste longe lanceolato-subulatis convolutis, margine lineari-areolato ad basin lato apicem versus angustiore vel evanescente circumductis, cellulis superioribus quadratis, inferioribus lineari-oblongis, alaribus ventricosis aureo-fuscis, costa debili percurrente apice dentata; capsula elongato-cylindracea erecta; operculo conico-aciculari. — On decayed logs. — A pale-green species, resembling small forms of *D. congestum*. Teeth of peristome light brown at base, yellow above; spores large. Belongs to the section *Leucoloma* of *Dicranum* (*Mull. Synop. Musc.*).

Gen. ANGSTRŒMIA, *Br. et Sch.*

36. A. GUILLEMINIANA, *Mont. Syll. Cryptog. p.* 44. — Banks, on mountain-sides.

37. A. VARIA, var. Hedw.; *Bryol. Europ. t.* 57, 58. — Road-sides.

Gen. CAMPYLOPUS, *Brid.*

38. C. GIGANTEUS (*sp. nov.*): procerus robustus luteo-viridis nitidus fusco-tomentosus parce ramosus; foliis in sicco vel humido reflexo-patulis longissime lanceolato-subulatis supra medium argute serratis minute quadrato-areolatis, cellulis alaribus permultis amplis fuscis, costa percurrente dorso maxime lamellosa; capsula in pedicello brevi cygneo-demissa ovato-gibbosa sulcata strumulosa; calyptra dimidiata basi albo-fimbriata; operculo longe rostrato. — Grows in wide, dense masses, on the summit of high mountains. A very large species, with stems 3-5 inches high, and leaves three fourths of an inch long.

39. C. CUBENSIS (*sp. nov.*): robustiusculus lutescenti-viridis nitidus purpureo-tomentosus innovando-ramosus subinterrupte foliosus; foliis longissimis siccis vel humidis reflexo-patentibus angustissime lanceo-

lato-subulatis superne argute serratis minute quadrato-areolatis, cellulis alaribus amplis ventricosis fusco-purpureis, costa dorso versus apicem lamellosa, lamellis serratis; capsula gibboso-ovali in pedicello sicco erecta, humido decurvo-cygneo demissa; operculo aciculari; calyptra dimidiata basi fimbriata. — Grows in dense tufts on the ground. — Not unlike large forms of *C. flexuosus*, but the margins of its leaf and the lamellæ on the back of the costa are serrulate.

40. C. TENUISSIMUS (*sp. nov.*): laxe cæspitans parce purpureo-tomentosus; caule tenuissimo flexuoso-erecto 4–5-ies innovando-continuo, innovationibus inferne appresso-foliosis veluti nudis; foliis comalibus paucis subverticillatis horizontalibus longissime setaceis apice dentatis, angulis baseos maxime dilatatis e cellulis magnis ventricosis purpureis constructis, areolatione alibi minuta subquadrata viridescente; archegoniis normalibus; capsula desiderata. — On decayed logs in dense forests. — A very slender species 1–2 inches long, remarkable for the subverticillate comal leaves on the successive innovations, which give the plant somewhat the aspect of a minute *Chara* or *Galium*.

Gen. HOLOMITRIUM, *Brid.*

41. H. CRISPULUM, *Mont.; Schwægr. Suppl. t.* 309. — Logs and bushes in thick woods.

42. H. WRIGHTII (*sp. nov.*): dioicum? robustum innovando-ramosum; foliis confertis horizontali-recurvis elongato- vel lineari-oblongis latiusculis acuminatis canaliculato-concavis vel subcomplicatis apice grosse irregulariter dentatis, cellulis oblongis apicem versus ellipticis chlorophyllosis, costa percurrente, perichætialibus longissime vaginantibus subito longe subulatis; capsula elongato-ovato-cylindracea; operculo e basi conica subulirostro; calyptra lineari dimidiata. — On trees in dense woods. — A dark-green species resembling *H. crispulum, Hornsch.*, which, however, has cauline leaves suddenly acuminate from a broad obovate base: in the present species the leaves are of a uniform width throughout, except at the point.

Gen. LEUCOBRYUM, *Hampe.*

43. L. TENUIFOLIUM (*sp. nov.*), *L. subulato* (*Hampe*) simillimum sed foliis latioribus brevioribus inferne multo angustius marginatis differt. — On decayed logs in thick woods. — Specimens without capsules.

44. L. ROBUSTUM (*sp. nov.*): a *L. longifolio*, cui proximum, statura

majore, foliis confertioribus secundis subfalcatis longioribus margine apicisque dorso integerrimis (nec scabris) distat. — Logs and roots of trees, in dense woods.

Gen. CALYMPERES, *Swartz.*

45. C. TENUIFOLIUM (*sp. nov.*): subacaule comoso-foliosum; foliis longissime setaceis siccis vel humidis strictis apice breviter acuminatis dentatis, habitu *C. Mulleri* (*Dz. & Mb.*) et *lonchophylli* (*Schw.*), qui distant hic foliis brevioribus siccis confertissimis, illic tamen affinior, foliis flavidis apice repando-truncatis edentatis. — Decayed wood. — Specimens without fruit.

Gen. SYRRHOPODON, *Schw.*

46. S. PROLIFER, *Schw. Suppl. t.* 180; var. foliis longioribus angustioribus siccis non tortuosis, humidis margine non flexuosis: forsan species propria. — Decayed wood.

47. S. GAUDICHAUDI, *Mont. Ann. Sc. Nat.* (1834), *p.* 376, *t.* 16. — Grows in large dense mats on logs in thick woods.

48. S. HOBSONI, *Grev. in Ann. Lyc. Nat. Hist. New York*, 1. *p.* 271, *t.* 23. — Trunks of trees in forests.

49. S. ELONGATUS (*sp. nov.*): cæspite valde compacta magna profunda; caulibus subsimplicibus erectis strictis longissimis; foliis e basi hyalina vaginante plus minus ciliato-dentata subito squarroso-reflexis subpendulisve lineari-lanceolatis acuminatis carinato-subcomplicatis anguste pellucido-limbatis, e cellulis minutis subquadratis opacis areolatis, apice spinuloso-dentato radiculas ramosas atropurpureas copiose emittentibus, costa percurrente: fl. et fr. desideratis. — Decayed logs and stumps. — Grows in deep close turfs, pale green above, reddish brown below. Stems 3 – 5 inches high, closely matted together throughout their entire length by masses of dark purple radicles growing from the points of their leaves, and forming a conspicuous feature.

Gen. MACROMITRIUM, *Brid.*

50. M. MUCRONIFOLIUM, *Schw. Suppl. t.* 170. — On trees.

51. M. CIRRHOSUM, *Brid.; Schwægr. Suppl. t.* 201. — Branches of trees on high mountains.

Gen. SCHLOTHEIMIA, *Brid.*

52. S. TORQUATA, *Brid. Bryol. Univ.* 1, *p.* 333; *Hedw. Sp. Musc. t.* 63. — Same locality as the last.

Gen. LEPTOTHECA, *Schwægr.*

53. L. Wrightii (*sp. nov.*): pseudo-monoica robusta densissime cæspitosa; caule subsimplici apice congesto-folioso; foliis obovatis spathulato-obovatisque tenuiter marginatis laxe mnioideo-areolatis, costa excurrente breviter cuspidatis, perichætialibus minoribus; capsula erecta gracili longe cylindracea annulata; perist. ext. dentibus longissimis linearibus valde papillosis, int. ciliis rudimentariis; operculo conico breviuscule rostrato; calyptra dimidiata subulata. — Decayed logs in dense woods. — A large species growing in compact dark-green turfs. Stems ½ – 1 inch high, matted together by reddish-brown tomentose radicles. Leaves crisped when dry, small and scattered on the lower part of the stem, rapidly increasing in size and crowded above. Pedicels ¾ – 1 inch high. Capsule light olive-green when ripe, the rim of the mouth coral-red. Annulus large, compound. Operculum whitish. Teeth of the peristome slender, remotely articulated, yellowish white above, reddish below, strongly papillose throughout. Minute male plants, evidently from the germination of spores, occur on various parts of the fertile plants. According to description, *L. speciosa*, H. & W., from the mountains of Jamaica, appears to be near our plant, but that species has ovate-lanceolate leaves.

Gen. DISSODON, *Grev. & Arn.*

54. D. ? rotundifolius, *C. Mull. Synop.* 1, *p.* 140; *Hook. Musc. Exot. t.* 76. — Moist rocks in ravines.

Gen. OCTOBLEPHARUM, *Hedw.*

55. O. albidum, *Hedw. Musc. Frond.* 3, *p.* 15, *t.* 16. — Decayed logs, etc.

Gen. BARTRAMIA, *Hedw.*

56. B. tenella, *C. Mull. Synop.* 1, *p.* 481. — Shady banks, on mountain-sides.

Gen. POGONATUM, *Beauv.*

57. P. Cubense (*sp. nov.*): *P. Liebmanniano* manifeste proximum, distinctum tamen statura graciliore, foliis oblongis brevius acuminatis laxioribus latioribus et brevioribus, capsula papillosa, etc. — On dry banks.

Gen. RHIZOGONIUM, *Brid.*

58. R. SPINIFORME, *Bruch.; Hedw. Musc. Frond.* 3, *t.* 25. — Ground, near the roots of trees; common.

Gen. BRYUM, *Dill.*

59. B. ARGENTEUM, *L.; Bryol. Europ. t.* 384; *var. lanatum.* — On the ground; common.

60. B. CORONATUM, *Schwægr. Suppl. t.* 71. — Old logs in fields.

61. B. CÆSPITICIUM, *L.; Bryol. Europ. t.* 374. — On the ground.

62. B. LEPTOCLADON (*sp. nov.*): dioicum tenellum laxe cæspitosum flavescenti-viride; caulibus brevissimis prostratis, innovationibus permultis erectis julaceis tenuissimis remotifoliis; foliis appressis oblongis breviter acutatis cymbiformi-concavis e cellulis amplissimis pellucidis inferne oblongis superne elongato-rhomboideis areolatis, unica serie cellularum indistincte marginatis, costa cum apice evanida; capsula oblongo-pyriformi leniter inclinata late annulata; perist. int. ciliis lanceolato-linearibus vix pertusis, ciliolis nullis; operculo hemisphærico-apiculato. — Moist places on the ground. — A very small species, forming loose yellowish-green patches, well marked by its numerous thread-like innovations, ¾ lines high, and about 1/7 of a line wide. Leaves with a large areolation in proportion to their size. Pedicels 5 – 6 lines high. This species belongs to Muller's section *Areodictyon* of *Bryum*.

63. B. OVALIFOLIUM (*sp. nov.*): dioicum cæspitans; foliis laxiusculis ovali-oblongis obtusiusculis modice cochleariformi-concavis, marginibus planis erectis, apice subincurva lenissime serrulatis, areolatione laxa, costa vix excurrente; capsula oblongo- vel clavato-pyriformi pendula. — Banks of rivulets. — A medium-sized species, distinguished from its allies by its oblong-oval, borderless leaves, with erect margins.

Gen. MNIUM, *Linn.*

64. M. WRIGHTII (*sp. nov.*): dioicum cæspitosum; caule arcuato-ascendente simplici complanato-folioso; foliis dimorphis lateralibus ovali-obovatis apiculatis dorsalibus accessoriisve multo minoribus anguste lanceolatis biseriatis, omnibus dissitis incrassato-marginatis ultra medium costatis laxe rhomboideo-areolatis, apice serrulatis; capsula in pedicello erecto pendula pyriformi; operculo depresso-convexo: flore masculo terminali disciformi, perigonialibus lineari-lanceolatis. — Shady

banks of mountain rivulets.—This remarkable moss, in its dimorphous leaves and their arrangement, may be looked upon as the acrocarpous analogue of *Rhacopilum*, as *Calomnion* is of *Hypopterygium*. About the size of *Mnium cuspidatum*. Leaves thin, rather firm, at first pale green, when old vinous red, the margins and costa deeper-colored. Pedicels ¾ – 1 inch long, occasionally two from the same perichæth.

Gen. CLASMATODON, *H. & W.*

65. C. PARVULUS, *Hampe; Sulliv. Mosses of U. States, p.* 60, *& Icones Musc. ined. t.* 79.— On roots and trunks of trees. The specimens vary from those of the Southern United States in a fuller development of the teeth of the peristome, and in the occasional presence of a few scattered hairs on the matured calyptra.

Gen. FABRONIA, *Raddi.*

66. F. CUBENSIS (*sp. nov.*): monoica, statura *F. pusillæ;* foliis ovato-lanceolatis integerrimis ultra medium costatis, cellulis ovali-rhomboideis laxiusculis chlorophyllosis, alaribus subquadratis granulosis; capsula oblonga subapophysata; perist. ext. dentibus sedecem per paria approximatis fuscidulis longiusculis, int. ciliis octo æquilongis filiformibus; operculo conico acuto. — On trees. — Remarkable for its double peristome, the inner of 8 cilia.

Gen. CRYPHÆA, *Mohr.*

67. C. FILIFORMIS, *Swartz.; Hedw. Musc. Frond.* 3, *t.* 16.— On coffee-bushes. The excurrent portion of the costa of the perichætial leaves is scabrous.

68. C.? LEPTOCLADA (*sp. nov.*): majuscula rigida; caule primario repente aphyllo, secundario pendulo subdendroideo-ramoso, ramis hic illic ramulos singulos fasciculatosve minutissimos appresso-foliosos proferentibus; foliis patentibus e basi subauriculata ovato- vel oblongo-acuminatis concavis margine erectis superne leniter serrulatis, cellulis alaribus permultis quadratis mediis lineari-fusiformibus prosenchymatosis apicalibus elongato-ellipticis, costa debili subpercurrente; capsula desiderata. — Bushes in ravines. — Grows in rather large masses. Secondary stems about 2 inches long, 1½ – 2 lines wide: foliage pale green and yellowish. A noticeable feature is the lateral fascicles of very minute straight shoots from the upper part of the branches: these shoots with their distant closely appressed ecostate lanceolate leaves are about 2 lines long and $\frac{1}{30}$ of a line wide, nearly concealed by the principal leaves.

Gen. ANOMODON, *H. & T.*

69. A. ATTENUATUS, *Hedw.; Bryol. Europ. t.* 475. — Rocks in ravines.

Gen. LESKEA, *Hedw.*

70. L. CAPILLARIS, *Hedw. Musc. Frond.* 4, *p.* 25, *t.* 10. — On trees.

Gen. CYLINDROTHECIUM, *Schimp.*

71. C. MACROPODIUM, *Hedw. Musc. Frond.* 3, *p.* 55, *t.* 23. — Rocks, mountain-sides.

72. C. AMPLIRETE (*sp. nov.*): robustum pallide virens nitidum late cæspitosum appressum dichotome divisum; ramis latis complanatis obtusis; foliis oblongis apice plus minus obtusis ibidemque grossius serratis, cellulis amplis; capsula deficiente. — Rocky ledges in woods. — The characters above given appear to distinguish this species from any of its known congeners.

Gen. HELICOPHYLLUM, *Brid.*

73. H. TORQUATUM, *Brid.; Hook. Musc. Exot. t.* 41. — On decayed wood.

Gen. RHACOPILUM, *Beauv.*

74. R. TOMENTOSUM, *Brid.; Hedw. Musc. Frond.* 4, *t.* 19. — On logs in woods.

Gen. PILOTRICHUM, *Beauv.*

75. P. UNDULATUM, *Beauv.; Hedw. Musc. Frond.* 3, *p.* 51, *t.* 21. — Trunks of trees.

76. P. FILICINUM, *Beauv.; Hedw. l. c. t.* 18. — Rocks in dense woods.

77. P. CYMBIFOLIUM, *Sulliv. Mosses U. States, p.* 81, *& Icon. Musc. ined. t.* 76.

78. P. LOPHOPHYLLUM (*sp. nov.*): dioicum? pusillum; caule primario repente, secundario erecto vix unciali inferne simplici reflexo-folioso superne pinnatim et bipinnatim dendroideo-ramoso; ramis ramulisque rigidis tenuissimis brevibus; foliis trifariis erecto-patentibus ovatis breviter acuminatis concavis subserrulatis sparsim papillosis pellucidis, cellulis oblongis ab invicem discretis, costis binis infra apicem abruptis dorso late cristatis; capsula ovali-oblonga ramigena brevipedicellata annulata; perist. ext. dent. lanceolato-subulatis, ciliis linearibus brevioribus; calyptra mitriformi sparsim erecto-pilosa operculum

conico-subulatum solum tegente; perichætialibus apertis elongato-lanceolatis breviter bicostatis. — Trees and decayed logs. — A small pale-green species scarcely 1 inch high, of a dendroid habit, with branches and branchlets very slender, about $\frac{1}{8}$ of a line wide. Near *P. compositum;* but that species, if the figure and descriptions of it are reliable, is a much larger plant, with different habit and leaves.

Gen. METEORIUM, *Dz. & Mb.*

79. M. MACRANTHUM, *D. & M. Pugil. Fl. Bryol. Venez. p.* 47, *t.* 12. — Trees and bushes.

80. M. PATULUM, *D. & M. op. cit. p.* 21, *t.* 10. — On trees.

81. M. CRINITUM, *Sulliv. in U. S. Expl. Exped. p.* 22, *t.* 20. — On bushes in dense thickets.

82. M. TRICHOPHORUM, *Mont. Ann. d. Sci. Nat.* (1843), *p.* 236. — On trees.

83. M. aff. nigricanti? — Without fruit; probably a new species: materials too imperfect to furnish a specific character.

84. M. ILLECEBRUM, *C. Müll. Synop. Musc.* 2, *p.* 137. — On high mountains.

Gen. HOOKERIA, *Smith.*

85. H. CUBENSIS (*sp. nov.*): dioica? dense cæspitans flavo-viridis; caule prostrata, ramis ascendentibus subsimplicibus compressis latis; foliis oblongis subobovato-oblongisve breviter acuminulatis pellucidis ampliuscule elliptico-areolatis immarginatis superne serratis, costis binis tenuibus ad medium evanidis; capsula in pedicello brevi superne scabro oblongo-elliptica erecta exannulata; perist. dent. longissimis angustissimis late marginatis linea mediali angusta notatis, ciliis æquilongis, membrana basilari vix ulla; operculo e basi elongato-conica subulato; calyptra mitriformi pilis latis sursum curvatis adspersa basi 8–10 fida. — On bushes in thick woods. — The erect capsule, pilose calyptra, and pedicel scabrous only on its upper half, sufficiently distinguish this species.

86. H. CYMBIFOLIA, *Hampe in Linnæa,* 1855, *p.* 783. — Logs in dense woods.

87. H. ADNATA, *H. & W. in Fl. N. Zeal. p.* 123, *t.* 93, *f.* 4. — Var. foliis oblongioribus minus acuminatis densius areolatis. — On the bark of trees.

88. H. VARIANS (*sp. nov.*): polygama dense cæspitosa flavicans; caulibus ramisque complanatis; foliis ovato-acuminatis et lanceolatis

flaccidis hyalinis amplissime rotundato-oblongoque-areolatis vix serrulatis limbo angusto e cellularum serie unica circumductis, ad medium tenuiter bicostatis; capsula elongato-oblonga horizontali; operculo conico subulato; calyptra mitriformi glabra, basi multifida; perist. *H. læte-virentis.* — Logs in dense woods. — Near *H. Olfersiana* and *H. albicans*, but the first species has entire leaves, an obovate capsule, and a calyptra scabrous at its apex; in the second, the leaf is oblong, shortly acuminate, and strongly dentate at apex. Specimens under this number (88) have synoicous and monoicous inflorescence.

89. H. VARIANS, var. infloresc. monoica colore glauco-viridi. — On decayed logs in forests.

90. H. VARIANS, var. infloresc. monoica foliis oblongioribus altius bicostatis. — Banks, mountain-sides.

91. H. INCURVA, *Hook. & Grev.; Schwægr. Suppl. t.* 275. — Logs in dense palm-woods.

92. H. MERKELII, *Hornsch. Fl. Bras.* 1, *p.* 62, *t.* 3. — Same locality as the last.

93. H. PAPILLATA, *Mont. Ann. d. Sci. Nat.* 1845, 4, *p.* 93. — Decayed logs in woods.

Gen. HYPNUM, *Linn.*

94. H. EXILISSIMUM (*sp. nov.*): monoicum minutissimum viride nitidum cæspitulosum; caule arcte repente; ramis capillaribus erectis simplicibus ramulosisque; foliis erecto-patentibus anguste oblongo-lanceolatis sensim acuminatis serrulatis mediotinus costatis, laxe areolatis, cellulis lineari-oblongis pellucidis alaribus numerosis quadratis concoloribus; capsula oblonga subæquali parum inclinata macrostoma; peristomio eciliolato; sporis majusculis; operculo oblique aciculari-rostrato. — On the bark of trees. — *H. acanthophyllum*, Mont., from the description (*Mull.* 2, *p.* 398) appears to be very near this moss, but differs in its horizontal capsule and carinate leaves destitute of special alar cells.

95. H. MINUTULUM, *Hedw.; Bryol. Europ. t.* 481. — Decayed logs and stumps in woods.

96. H. SCHISTOCALYX, *C. Mull. Synop.* 2, *p.* 691? — Locality same as the last.

97. H. TAMARISCINUM, *Dill.; Bryol. Europ. t.* 482 and 483. — Decayed logs.

98. H. INVOLVENS, *Hedw. Musc. Frond.* 4, *t.* 11. — Same as the last.

99. H. MICROPHYLLUM, *Sw.; Hedw. Spec. Musc. t.* 69. — Ground and stones in fields.

100. H. APICULATUM, *Hornsch. Fl. Bras. p.* 87. — Logs on margins of rivulets.

101. H. CUPRESSOIDES, *C. Mull. Synop.* 2, *p.* 303. — Fallen trees in forests.

102. H. INSULARUM (*sp. nov.*): monoicum *H. cupressiformi* simillimum majusculum; ramis latiuscule complanatis; foliis falcato-secundis longe subulatis vix serrulatis, cellulis alaribus utrinque ternis magnis oblongis aureis vesiculæformibus, perichætialibus erectis; capsula in pedicello tenui longissimo parva gibboso-ovali; operculo longe aciculari-rostrato. — Decayed logs. — The broad flat, shining branches, the long slender pedicel, the small capsule, the long rostrate operculum, and the large ventricose alar cells of the leaf, are the distinguishing marks of this species.

103. H. SERRULATUM, *Hedw. Sp. Musc. p.* 238, *t.* 60. — On the ground among decayed leaves.

104. H. PUNGENS, *Hedw.; D. & M. Prod. Fl. Bryol. Surinam. p.* 35, *t.* 19. — Trees and bushes.

105. H. WRIGHTII, *Sulliv. Mosses of U. States, p.* 65, *& Icon. Musc. t.* 127 *ined.* — Roots of trees, etc.

106. H. LOXENSE, *Hook.; Schwægr. Suppl. t.* 259. — Bushes in ravines.

107. H. TENERUM, *Sw.; Mull. Synop. Musc.* 2, *p.* 397. — On the ground and decayed wood, common.

108. H. ACESTROSTEGUM (*sp. nov.*): monoicum exiguum prostratum intertextum luteolo-viride nitidum; caule ramis ramulisque numerosis compressis inordinate subpinnatimve dispositis instructa; foliis confertis e basi constricta oblongo-ellipticis cymbiformi-concavis in pilum longum denticulatum productis ecostatis pellucidis minute lineari-areolatis, cellulis alaribus magnis ventricosis aureis; capsula in pedicello lævi oblongo-ovali exannulata cernua vel pendula; perist. dent. linea lata notatis, ciliolis singulis; operculo longissime aciculari; calyptra angusta dimidiata. — On the bark of trees. — The leaf in shape and structure resembles that of *H. Schwaneckianum* (*C. Mull. in Bot. Zeit.* 1858, p. 172), which however is a larger species with different ramification and inflorescence.

109. H. PLANUM, *Brid.; Schwægr. Suppl. t.* 280. — Logs and stumps.

110. H. PLANUM, var. flavescens; *Mull. Synop.* 2, *p.* 261. — Decayed wood.

111. H. BEYRICHII, *Hornsch. in Fl. Bras.* 1, *p.* 81, *t.* 4, *f.* 1. — Logs in dense woods.

112. H. FLEXUOSUM (*sp. nov.*): dioicum; caule arcte repente pinnato; foliis flaccidis pellucidis albido-viridibus confertis leniter incurvis subdecurvisque lanceolatis in acumen longum loriforme flexuosum grosse dentatum productis laxissime ample elongato-areolatis ecostatis; capsula in pedicello longiusculo apice clavato-incrassato cylindracea horizontali curvula annulata: operculo conico-rostrato. — On dead wood. — Resembles Schwægrichen's figure (*Suppl. t.* 200) of *H. leptocarpon*, but that appears to be a larger species with monoicous inflorescence, and leaves with large ventricose alar cells.

113. H. FLEXUOSUM; planta mascula. — With the last.

114. H. LEUCOSTEGUM, *C. Mull. Synop.* 2, *p.* 344. — Logs in dense woods.

115. H. CALLIDUM, *Mont. in Ann. Sci. Nat.* 1845, 4, *p.* 90. — On trees.

116. H. SENTOSUM (*sp. nov.*): *H. papilloso* simillimum, diversum tamen caulibus prostratis subpinnatis, foliis apice tenuiore grosse dentato papillisque longioribus instructis, pedicello toto lævi, perist. dentibus linea lata pellucida notatis, etc. — On branches of trees.

117. H. SCHWANECKIANUM, *C. Mull. in Bot. Zeit.* 158, *p.* 172. — On trees.

118. H. DEMISSUM, *Wils.; Bryol. Europ. t.* 507. — Moist rocks, mountain-sides.

119. H. REPTANS, *Schw.; Hedw. Sp. Musc. t.* 68. — Logs in shady woods.

120. H. MONTAGNEI, *Schimp. in Mont. Crypt. Cub. p.* 530, *t.* 20. — On decayed logs in forests. — A widely distributed species, found in Manilla, Java, Loo Choo, Hong Kong, Nepal, West Indian Islands, Venezuela, Brazil, Peru, Tahiti, and Sandwich Islands. Subject to considerable variation in its size, and also in the length of the point of the leaf; in other respects quite uniform. Authentic specimens of *H. Montagnei*, Schimp.; *Meyenianum*, Hampe; *Surinamense, D. & M.; apertum*, Sulliv.; *succosum*, Mitten, show that they all belong to the same species; and to this list of synonymes it is highly probable the following should also be added: *H. rutilans*, Brid.; *Pœppigianum*, Hampe; *vesiculare*, Schwægr.; *subdenticulatum* and *conostegum*, Mull.

121. H. ADMISTUM (*sp. nov.*): *H. microcarpo* (*Mull.*) simillimum sed differt capsula inæquali obovata leniter incurva cernua, etc. — On the bark of trees. — Scarcely distinguishable from *Leskea adnata*, Michx. (= *H. microcarpum*, Mull.), founded on Southern United States specimens, except by the capsule, which in that species is always oblong, erect, and equal-sided. It is probable the moss under notice is the same as the St. Croix specimens, referred to Michaux's species by Schwægrichen (*Suppl. t.* 84), and from which Figs. 1 and 2 of that plate were taken.

122. H. DISSOLUTUM (*sp. nov.*): monoicum *H. admisto* simile, diversum tamen statura majore, cæspite laxe cohærente, ramis eradiculosis longioribus robustis rectis obtusis, foliis latioribus vix secundis, capsula majore oblongo-incurva cernua, etc. — On dead wood.

123. H. DISSOLUTUM, var. statura robustiore. — Same locality.

124. H. THELISTEGUM, *C. Mull. Synop.* 2, *p.* 269. — Rocks in shaded ravines.

125. H. THELISTEGUM, var. major. — Similar localities.

126. H. CULTELLIFORME (*sp. nov.*): monoicum prostratum complanatum parce ramosum sericeo-viride; foliis laxe bifariis asymetrice ovato-oblongis obtuse acuminatis lateralibus sæpe subaciniformibus ad medium costatis serrulatis, cellulis exilissimis lineari-flexuosis alaribus quadratis; capsula oblongo-ovali horizontali; operculo conico longius rostrato. — Flat rocks in shaded ravines. — Resembles in general aspect and manner of growth *H. deplanatum*, Schimp., but that species is somewhat larger, with a dioicous inflorescence.

127. H. CÆSPITOSUM, *Swartz?* — On decayed wood, very common. — This species agrees well with the description by Müller (*Synop.* 2, *p.* 330) of the moss above named, but can hardly be the one figured by Hedwig (*Sp. Musc. t.* 49) as Swartz's species. Hedwig's figure, according to Wilson (*Fl. N. Zeal. p.* 113), does not agree with specimens in *Herb. Hook.* named *H. cæspitosum* by Swartz himself. The specimens here under notice accord exactly with South American ones from Hampe marked *H. Gallipense*, C. Mull., which in the synopsis l. c. is reduced to *H. cæspitosum*, Swartz.

128. H. LÆTUM, *Brid.; Sulliv. Icon. Musc. t.* 115, *ined.;* non *Bryol. Europ.* — Rocks, mountain rivulets.

129. H. RIPARIUM, *Linn.; Bryol. Europ. t.* 570. — Wet places.

Gen. HYPOPTERYGIUM, *Brid.*

130. H. Brasiliense, *Sulliv. in Bot. U. S. Expl. Exped. p.* 26, *t.* 26. — Rocks, in dense woods.

Gen. PHYLLOGONIUM, *Brid.*

131. P. fulgens, *Hedw. Musc. Frond. t.* 39. — Trunks of trees.

In this interesting collection are to be found eight or ten other species, several of them doubtless new, but the specimens are too imperfect for satisfactory identification or description.

Mr. F. H. Storer made the following remarks, in behalf of Mr. John M. Ordway and himself, upon

The Frozen Well at Brandon, Vermont.

Respecting the geological situation and general character of this remarkable well, which has been fully and accurately described by others,* we have nothing new to offer; but we desire to call the attention of the Academy to an important phenomenon that appears to have escaped the notice of previous observers. On visiting the locality in the early part of the present summer, we ascertained the existence of a variable but well-marked current of cold air continually flowing upwards out of the mouth of the well.

When we first visited the spot, in the morning of the 8th of June, the external air being somewhat cool, the ascending current was not noticed; but returning at two o'clock in the afternoon for a more thorough examination, the atmosphere having in the mean time become uncomfortably warm, we at once became sensible of a rush of cold air on bending over the well-curb to look down. This current was still more distinctly felt by placing the hand down near the mouth of the well. Bits of any light material dropped in were buoyed up and forcibly blown out. The mature pappus of the dandelion, which was then in full puff all around, afforded an abundance of very sensitive current indicators. Rolls of paper, slightly damp, being burned just within the mouth of the well, furnished volumes of smoke, which were rapidly expelled, and not only confirmed the existence of a current, but enabled us in some measure to trace the deviations in its course. At three o'clock, the ascent of a column of cold air was still further proved, by holding a thermometer in the opening of the well, the bulb being at the level of the ground, at a point where surely mere radiation from the ice, some thirty feet below, should be fully counterbalanced by the heat radiated to the mercury from the curb and windlass that had been all day exposed to the hot sun. The thermometer there indicated 43°.5 F., the temperature of the external air being 78°. About five feet below the mouth, the thermometer stood at 43°, and twelve feet down, at 40°. Water drawn up from the bottom — without stopping to cool the bucket — was at 34°. Water drawn up at other times contained lumps of ice detached from the coating of ice lining the well to the height of some five feet above the surface of the water. When a candle was lowered down, this ice appeared to be worn away on the northwest side, as though small rills of warmer water were coming in from that direction.

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* See Proceedings of the Academy for 1859, IV. 269. Proc. Boston Soc. Nat. History (1859-61), VII. 71, 74, 81. Wells's Annual Sci. Disc., 1860, p. 316; compare Ibid. 1856, p. 190.

We visited the well at different times during the two following days, and found the current as decided as when first perceived. In the cool of the morning it expelled the dandelion pappus as readily as at any other time, though then, from the want of contrast with external heat, it was less felt by the hand or face. Calling the attention of the owner and one of his neighbors to the sensible upward flow of air, we were told by both, that "cold air blows out" of the well constantly, and has always done so. A remark expressed in such terms was somewhat surprising, since the proprietor had assured us on our first visit that no current existed in the well, as had been repeatedly proved by lowering down a candle, which burned steadily in any part. We finally repeated the candle experiment, and found, as might have been expected from the gentle upward current filling the whole circumference of the well, that the flame was not positively deflected, except just below the edge of the opening in the marble slab capping the wall. This hole, being of less diameter than the well itself, compels the air, rising at the sides, to sweep towards the centre, and accordingly, at all points within reach of the influence of this centripetal contraction in the column, the flame of the candle was turned inwards. This blowing of the candle towards the middle from all parts of the circumference of the orifice, is worthy of remark, as showing — what, indeed, the appearance of the ground outside would indicate — that the dirt is so compacted around the marble slab, that the motions of the external atmosphere can do nothing towards producing the current. It shows, too, that at the only place where an *upward* flow could affect a candle, there the deflected flame renders the rush of air apparent. We dwell more particularly on this point, because Messrs. Jackson and Blake, in their communication to the Academy,* have denied the existence of any current in the well, since the flame of their candle was not observed to deviate from its natural course; and because, from the confusion of ideas exhibited by those residing at the locality, it would seem as though there had been entertained a vague notion that a draught or current ought necessarily to be horizontal. In reality, the direct upward course is what would naturally result from the combination of numerous opposing rills of air, coming in from all sides through the loose gravel and cracks in the frozen deposit, and, while seeking the point of least resistance, gradually curving towards the perpendicular direction, even before reaching the stones of the lining wall. If there are, indeed, any single streams of more than the average force, they might be found by running an impervious vertical partition down the middle of the shaft, and then making a smoke close to the joints of the stones in the wall. But the fact that the owner of the ground has only this well to supply water for the daily use of his family, precludes the carrying out of such experiments.

We had hardly begun to make close observations, before it occurred to us that we were dealing with a case of compressed air, which might be accumulated by some natural subterranean *water-trumpet* (*Wassertrommel*), or "Catalan blower," and which, expanding as it approached the surface of the earth or escaped into this artificial outlet, would absorb and render latent a large amount of heat, and could thus effect the gradual refrigeration and actual freezing of a considerable body of wet gravel.† The flow of air — which would otherwise be so diffused as to have no appreciable force at any part of the surface of the drift bed — should become especially apparent in this vent bored down through the overlying clay and fine soil into the very coarse and uncommonly pervious gravel. That the gas expelled differs little, if any, from atmospheric air, is shown by the free burning of the candle, as well as by the lack of any impression produced on the senses, except that arising from mere coldness.

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* Proceedings, IV. 270.

† For a valuable series of experiments made by Dr. John Gorrie, on the absorption of heat by condensed air in the act of expanding, — with particular reference to the economical production of ice, — see Am. Journ. Sci. for 1850, [2.] X. 39, 214; Ann. Sci. Disc., 1851, p. 57.

Considering that the drift heap in which the well is situated rests evidently on limestone, and is not far distant from the junction of the limestone with the mica slate, or gneiss, we may easily conceive of the occurrence of such caverns, fissures, natural conduits, and subterranean water-courses as might complete an arrangement on the principle of the water-trumpet, — one of the oldest contrivances for securing a blast to be used in iron-furnaces, — and thus afford a constant and ever-renewed supply of condensed air. And, as the experiments of Dr. Gorrie show that but a moderate degree of condensation is necessary to enable air to become freezing cold by its return to the normal bulk, we may be warranted in saying that such a cause, though of moderate power and having various impediments to overcome, would be sufficient to produce all the effects observed in the case under consideration. Of course, the colder the air at first, and the colder the compressing and cooling water, the greater would be the refrigeration resulting from the subsequent expansion. And the actual freezing must proceed with greater rapidity at that time of the year when the accumulated heat of the soil is allowed the freest radiation, together with the least chance of increase. In fact, it is said to be a matter of yearly observation, that the well "begins to feel the cold weather," and to freeze over in autumn long before there are any heavy frosts above, and, indeed, while the ground is still open for tillage. This, certainly, would seem to indicate a cause continually operating with almost uniform force.

Since our return from Brandon, we find that the senior editor of the American Journal of Science,* in commenting on an account of the frozen well at Owego,† makes the simple remark, that the phenomenon might possibly be occasioned by the escape of compressed air; but how the air could be condensed, and how or why the effect should follow from such a cause, he does not point out. It does not, therefore, appear whether or not Prof. Silliman had in his mind a theory similar to ours. Excepting this indefinite suggestion, we have met with no hypothesis capable of explaining all the facts in the case.

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* Am. Journ. Sci., 1839, [1.] XXXVI. 185.

† The Brandon well was not in existence at that time.

The supposition that the current observed might come from air of ordinary tension, cooled and stored in ice-caverns during the winter months, and afterwards expelled by water filling up these reservoirs, fails to meet the case. For if there were any accumulation of cold air made during one winter sufficient to hold over till the next, we might expect a gradual diminution of effect from spring till the middle of the following winter, instead of an increase on the first approach of cold weather in autumn. The same objection applies with equal force to the conjecture that winds penetrate the earth through some distant lower inlet, and in winter refrigerate the mass of gravel to an extraordinary degree. And it may be further said respecting the latter idea, that in summer cold air could not rise through a great body of gravel and flow out into the warmer and lighter superincumbent atmosphere, without some powerful *vis a tergo* to enable it to overcome inertia, friction, and gravity, — a force which, being then entirely unaided by any forward draught, must be far greater than could be supplied by any ordinary winds, even under the most favorable circumstances. But even if we suppose winds could blow through ice-caves underground, and permeate the earth above, we still have the ice-caves themselves to account for, as well as the constant renewal of the ice.

But not intending to lay too much stress on the water-trumpet hypothesis, which, of course, is not entirely free from drawbacks, and may or may not be the true explanation of the singular phenomena under discussion, we wish more particularly to bring forward to the notice of the Academy the fact of the continual rush of cold air out of the well at Brandon, — a current probably having some connection with the freezing below. And we may be allowed to remark that, in the case of this particular well at least, any theory which fails to assign a sufficient cause for the continued efflux leaves out of account a matter hardly less wonderful than the perennial congelation itself.

An incidental point worthy of attention is the asserted uniformity in the depth of the water — or ice and water — at all times of the year. Had there been an engineer's level at hand, enabling us to ascertain the relation of the surface of the water in the well to the level of brooks and low grounds not far distant, we might have gathered some positive data having a bearing on the subject. But it would be useless to reason on uncontrolled estimates; and, without dwelling on some other facts not sufficiently studied, we will simply put on record the temperatures of other sources of water opened in and near this limited drift bed. 1st. In a spring sunk to about the depth of ten feet from the surface, — a stone's throw northwest of the frozen well, at the side of the lane leading out of the main road, — the water at top stood at 54° F., and that near the bottom, at 50°. 2d. A similar spring about twelve feet deep, three or four rods west of No. 1, showed a temperature of 50° in water drawn from the bottom. Both these small wells are evidently fed by surface water, and, at the time of our visit, they were filled nearly up to the level of the ground. 3d. In a shallow spring at some distance southwest of the frozen well, in lower ground, and apparently near the limit of the drift, the water stood at 48° F. A deep well in the mica slate formation, about half a mile west, stood at 45° F.

It is to be hoped that the well, and the bed of frozen gravel in which it is situated, may be made the subject of careful experimental investigation. It would, of course, be interesting to ascertain the precise limits and conditions of variation in the current of air. It is also desirable that the *contour* of the drift heap and the grounds adjoining should be accurately determined.

Four hundred and ninety-eighth meeting.

September 10, 1861. — Monthly Meeting.

The President in the chair.

The Corresponding Secretary read letters relative to the exchanges of the Academy.

Professor Horsford illustrated the several methods recently suggested and employed for rendering linen and cotton fabrics uninflammable.

Professor Peirce made a communication upon the discrepancy between the observed and the calculated acceleration of the moon's motion, and the question whether it may be due to the influence of meteoric bodies about the earth.

Mr. Swett exhibited a piece of leather, in the form of a breastplate, prepared so as to be impenetrable by the thrust of a bayonet, and explained the method of preparation.

Four hundred and ninety-ninth meeting.

October 8, 1861. — Monthly Meeting.

The President in the chair.

Professor Sophocles read the following communication: —

Remarks on the Dialect of Tzakoniá.

There is no historical evidence that the less-cultivated dialects of ancient Greece were written or spoken after the close of the third century of our era.* The language of Constantinople, the new capital of the Roman empire, was a continuation of later Greek. For about eleven centuries it was the language of books, of imperial edicts, of ecclesiastical canons, and of the ritual of the Eastern Church. Which being the case, it was naturally more or less employed by all those whose mother tongue was the Greek, in whatever part of the empire they might be found. This seems to be the principal reason why the Byzantine Greek was not subdivided into new dialects.

The Romaic, or Modern Greek, the immediate offspring of Byzantine Greek, cannot be said to have dialects, as this word is commonly used by grammarians. The Greek inhabitant of Epirus, Macedonia, or Thrace finds no difficulty in conversing with the native of Crete,

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* The following passage, in which Porphyrogenitus speaks of the Ægean Sea, is apparently a confused quotation from Artemidorus the geographer, who died very near the beginning of the first century before Christ. Porphyrogenitus, Them. 1, 17, p. 42 *Ὁμοίως δὲ καὶ ὁ Ἀρτεμίδωρος τὰ αὐτά φησι τῷ Στράβωνι· Ἄκρα τις ἔστιν Αἰολίδος, ἣν Αἶγα οἱ ἐπιχώριοι ὀνομάζουσιν, ἀφ' ἧς καὶ τὸ πέλαγος τὴν τοιαύτην ὀνομασίαν προσείληφεν. Αἰολίδος δὲ λέγω οὐκ ἔθνους ὀνομασίαν, ἀλλὰ γλώττης ἰδίωμα· ἡ γὰρ τῶν Ἑλλήνων γλῶττα εἰς πέντε διαλέκτους διῄρηται. . . . . Καὶ ἀπὸ μὲν τῆς Μιλήτου μέχρι τῆς Ἐφεσίων πόλεως καὶ αὐτῆς Σμύρνης καὶ Κολοφῶνος Ἰώνων ἐστὶ κατοικία, οἵτινες τῇ τῶν Ἰώνων διαλέκτῳ χρῶνται. Ἀπὸ δὲ Κολοφῶνος μέχρι Κλαζομενῶν καὶ τῆς ἀντιπέραν τῆς Χίου γῆς καὶ αὐτῆς τῆς Μιτυλήνης καὶ τοῦ καλουμένου Περγάμου Αἰολέων ἐστὶν ἀποικία, οἵτινες διαλέκτῳ χρῶνται τῶν Αἰολέων. Τὰ δὲ ἐπέκεινα τούτων ἀπὸ τοῦ λεγομένου Λεκτοῦ καὶ ἕως Ἀβύδου καὶ αὐτῆς Προποντίδος καὶ μέχρι Κυζίκου καὶ τοῦ ποταμοῦ τοῦ λεγομένου Γρανίκου πάντες Γραικοὶ ὀνομάζονται καὶ κοινῇ διαλέκτῳ χρῶνται, πλὴν Βυζαντίων, ὅτι Δωριέων ἐστιν ἀποικία.* It will be observed that Artemidorus divides the northwestern coast of Asia Minor, not according to race, but according to language.

Rhodes, or Cyprus. As to vulgarisms and local and slang terms, which abound in every district and large town, they cannot with any degree of propriety be classed with dialectic peculiarities. Their existence is usually ephemeral, and as a general thing they are of little value to the philologist.

A few centuries ago, a Greek by the name of Kabhásilas asserted that the number of dialects into which the popular Greek was subdivided was over seventy. Now, if by dialects he meant anything, he must have meant *patois;* and if so, he ought to have added many more; for the illiterate of almost every village have their peculiar barbarisms. If it be asked why he selected seventy as the round number, we may answer that Kabhásilas, in common with all the ignorant of the East, was a believer in the marvellous properties of certain numbers, of which seventy is one. For, in the first place, it is the product of the sacred number seven and of the perfect number ten; the perfection of the latter emanating from the mystical fact that it is contained in the quaternary, the source of inexhaustible nature, as the Pythagoreans express it. Secondly, this number appears more than once in the Bible. Thus, we have threescore and ten palm-trees in the desert of Sinai, and seventy disciples. Thirdly, the Old Testament was translated by seventy interpreters (the celebrated Septuagint), every one of whom was inspired during the laborious process of translating, and often mistranslating, Hebrew into Greek. It is true that, according to the legend, the version was the work of seventy-two learned Jews, each tribe having furnished six accomplished scholars; but as seventy-two is not remarkably mystical, it was thought proper by the regulators of religious opinion to reduce it to seventy. Further, the ignorant believe that Saint Luke the Evangelist painted seventy wonder-working pictures of the Virgin, one of which is now in the principal church of Tenos, and another in Bologna. And if any one doubts whether Luke was a painter, the priest informs him that Saint John of Damascus, one of the great fathers of the Church, distinctly states that the Evangelist painted the picture of the Virgin, and sent it as a present to his friend Theophilus.[*] And if he could paint one, he might have painted seventy.

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[*] JOANNES DAMASCENUS, I, p. 618 D *Βλέπε μοι καὶ τὸν εὐαγγελιστὴν καὶ ἀπόστολον Λουκᾶν· οὐχὶ τῆς παναχράντου καὶ ἀειπαρθένου Μαρίας τὴν τιμίαν εἰκόνα ἀνιστόρησε καὶ πρὸς Θεόφιλον ἔπεμψε;*

On the eastern shores of Peloponnesus there is a small district called *Tzakonía*, or *Tzakoniá* (in three syllables). It is contained in the ancient *Cynuria*, which lay between Argolis and Laconia.* The language spoken by the inhabitants of this region is unintelligible to those whose mother tongue is the Romaic. To the philologist it is nothing more than a very barbarous Romaic. In the common language of the Greeks, the corruptions or changes are in a great measure systematic, and it is very easy for the critical scholar to trace them to their mediæval and ancient sources. But the dialect of Tzakoniá is apparently a jargon, in the usual acceptation of the term. It is broken Greek. Many of its roots, indeed, are traceable to the Greek, but its inflections usually deviate from the Greek type. In short, it is not a regularly developed modern Greek *patois*. And the question is, when and under what circumstances it came into being.

In investigating the affinities of a language, one of the first requisites is to examine its pronouns, pronominal adjectives, pronominal adverbs, numerals, case-endings, and personal endings (which are in reality fragmentary pronouns). These elements constitute its essential characteristics. And when a language loses them, it loses, as it were, its consciousness. If we apply this rule to the language of Tzakoniá, it will be found that many or most of these characteristics are so different from those of the Romaic, and their resemblance to the corresponding words in Greek is so general, that they may be referred to more than one of the Indo-European languages. Thus, its word for ἐγώ is ἐσού, which has the elements of the ecclesiastical Slavic ăζ. For σύ it has ἐκιοῦ (in two syllables), and for τί, τζές, which does not differ from the Slavic *tsh*εσὸ.

Some scholars fancy they discover Doricisms and Ionicisms in this dialect; and by a natural process of reasoning they infer that the Tzakoniots are a remnant of the ancient Cynurians, an aboriginal people, whom Herodotus was inclined to regard as *Doricized Ionians*, that is, Ionians who in the course of time adopted the manners, customs, laws, and dialect of the Dorians.[*] Now whenever a classical scholar goes to Greece to find Dorians and Ionians, it is ten to one but that he succeeds in finding Dorians and Ionians. He selects such words and phrases and facts as are agreeable to his hypothesis, and takes no notice of those which contradict it. He lays much stress upon coincidences, but disregards differences. He overlooks the fact that the genuine Romaic contains infinitely more Doricisms than the jargon of Tzakoniá. If the modern Tzakoniots were the descendants of the Doricized Ionians of Herodotus, we should naturally expect to find a great similarity between their language and that now used in Crete, Melos, Thera, Carpathus, Rhodes, and other Doric islands.

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* The villages in which this dialect is spoken are the following: ἡ Καστάνιτζα, ἡ Σίτενα, τὸ Πραστόν, τὸ Λενίδι, τὸ Μελανόν, τὸ Δερόν, τὰ Καλύβια τοῦ ἁγίου Ἀνδρέου, τὰ Κουνούπια. The original forms of Σίτενα, Πραστόν, and Λενίδι are Προάστειον, Λεωνίδας, and ὁ Σίταυας, all found in PHRANTZES, p. 159.

What was, then, the origin of this dialect? Before we attempt to answer the question, it will be necessary to ascertain what foreign races migrated to Greece after it became a Roman province.

Of all the barbarians that overran Greece previously to the ninth century, the Slavs alone are represented by the Byzantine historians as having permanently settled in Greece. They began to come in contact with the Greeks in the early part of the sixth century. And for nearly two hundred years after they crossed the Danube they, conjointly with other barbarians, did little else than devastate Illyria, Thrace, and Greece.[†] Soon after the terrible plague which, in the middle of the eighth century, visited Southern Italy, Sicily, and Greece, the Slavs established themselves as settlers in the depopulated provinces of continental and peninsular Greece. "Only those escaped death who fled from the infected regions," says Saint Nicephorus the Confessor.[*] According to Porphyrogenitus, all the rural districts of Greece (*ἡ χώρα*) were occupied by the Slavs and became barbarous, when Constantine Copronymus the iconoclast was Emperor.[†] The anonymous epitomizer of Strabo, who must have lived after the eighth century, says, "And now the Slavic Scythians occupy nearly the whole of Epirus, Hellas, Peloponnesus, and Macedonia." And again, "But now the names Pisatae, and Caucones, and Pylians are not used; for all these regions are inhabited by Scythians";[‡] *Scythians*

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[*] Herod. 8, 73 *Οἰκέει δὲ τὴν Πελοπόννησον ἔθνεα ἑπτά. Τούτων δὲ τὰ μὲν δύο αὐτόχθονα ἐόντα κατὰ χώραν ἵδρυται νῦν τῇ καὶ τὸ πάλαι οἴκεον, Ἀρκάδες τε καὶ Κυνούριοι ..... Οἱ δὲ Κυνούριοι αὐτόχθονες ἐόντες δοκέουσι μοῦνοι εἶναι Ἴωνες, ἐκδεδωρίευνται δὲ ὑπό τε Ἀργείων ἀρχόμενοι καὶ τοῦ χρόνου, ἐόντες Ὀρνεῆται καὶ περίοικοι.* Thuc. 5, 41 *Τῆς Κυνουρίας γῆς .... νέμονται δ' αὐτὴν Λακεδαιμόνιοι.* Strab. 8, 6, 17 *Κυνουρία*, substantively.

[†] Procopius, II, p. 397, 18 (A. D. 547) *Ὑπὸ τοῦτον τὸν χρόνον Σκλαβηνῶν στράτευμα διαβάντες ποταμὸν Ἴστρον Ἰλλυριοὺς ἅπαντας ἄχρι Ἐπιδαμνίων ἔδρασαν ἀνήκεστα ἔργα.* 449 (A. D. 550) *Ἴστρον δὲ ποταμὸν διαβάντες ἀμφὶ Ναϊσὸν ἦλθον, κ. τ. λ.* Menander, p. 404, 15 (A. D. 576) *Ὅτι κεραϊζομένης τῆς Ἑλλάδος ὑπὸ Σκλαβηνῶν, κ. τ. λ.* Malalas, p. 490, 6 *Μηνὶ μαρτίῳ ἰνδικτιῶνος Ζ' ἐπανέστησαν οἱ Οὖννοι καὶ οἱ Σκλᾶβοι τῇ Θρᾴκῃ, καὶ πολεμήσαντες πολλοὺς ἀπέκτειναν, καί τινας ἐπραίδευσαν.* Theophanes, p. 360 (A. D. 551 + 8) *Τῷ δ' αὐτῷ ἔτει ἐπανέστησαν Οὖννοι καὶ Σκλάβοι τῇ Θρᾴκῃ πλήθη πολλά.* 532 (A. D. 656 + 8) *Οἱ δὲ Σκλαβινοὶ τούτῳ [τῷ Ἀβδεραχμὰν] προσρυέντες σὺν αὐτῷ ἐν Συρίᾳ κατῆλθον χιλιάδες πέντε, καὶ ᾤκησαν εἰς τὴν Ἀπάμειαν χώραν ἐν κώμῃ Σκευοκοβούλῳ.* 559 (A. D. 683 + 8) *Τούτῳ τῷ ἔτει Ἰουστινιανὸς ἀπελέξατο ἐκ τῶν μετοικισθέντων ὑπ' αὐτοῦ Σκλάβων καὶ ἐστράτευσε χιλιάδας Λ', καὶ*

ὁπλίσας αὐτοὺς ἐπωνόμασεν αὐτοὺς λαὸν περιούσιον, ἄρχοντά τε αὐτῶν Νέβουλον τοὔνομα.

The K in Σκλάβος, Σκλαβηνός, and the Θ in Σθλάβος, do not belong to the radical portion of these forms: they were introduced by the Greeks in order to bring them under the analogy of *σκληρός*, *σθένος* or rather *ἐ-σθλός*.

[*] THEOPHANES, p. 651 (A. D. 738 + 8) *Τῷ δ' αὐτῷ ἔτει λοιμώδης θάνατος ἀπὸ Σικελίας καὶ Καλαβρίας ἀρξάμενος, οἷόν τι πῦρ ἐπινεμόμενον ἐπὶ τὴν Μονοβασίαν καὶ Ἑλλάδα καὶ τὰς παρακειμένας νήσους ἦλθεν δι' ὅλης τῆς ΙΔ' ἰνδικτιῶνος.* 652 *Ἡ δὲ αὐτὴ λοιμικὴ νόσος τοῦ βουβῶνος ἀνέδραμεν τῇ πεντεκαιδεκάτῃ ἐπινεμήσει ἐν τῇ βασιλίδι πόλει.* NICEPHORUS CONSTANTINOPOLITANUS, p. 70, 11 *Καθ' οὓς τόπους τὸ φθοροποιὸν ἐπεφύετο πάθος, ἅπαν ἀνθρώπων γένος ἐπινεμόμενον διέλυέ τε καὶ ἄρδην ἐξηφάνιζε. Διεσώθη δ' ἄν τις θείᾳ πάντως βουλήσει, ὅστις ὡς πορρωτάτω τούτων τῶν χωρῶν ἀπέδρα. Ἐπετείνετο δὲ τὰ τῆς φθορᾶς μάλιστα περὶ τὸ Βυζάντιον.*

[†] PORPHYROGENITUS, Them. p. 53 *Ἐσθλαβώθη δὲ πᾶσα ἡ χώρα καὶ γέγονε βάρβαρος, ὅτε ὁ λοιμικὸς θάνατος πᾶσαν ἐβόσκετο τὴν οἰκουμένην, ἡνίκα Κωνσταντῖνος ὁ τῆς κοπρίας ἐπώνυμος τὰ σκῆπτρα τῆς τῶν Ῥωμαίων διεῖπεν ἀρχῆς. Ὥστε τινὰ τῶν ἐκ Πελοποννήσου μέγα φρονοῦντα ἐπὶ τῇ αὐτοῦ εὐγενείᾳ, ἵνα μὴ λέγω δυσγενείᾳ, Εὐφήμιον ἐκεῖνον τὸν περιβόητον γραμματικὸν ἀποσκῶψαι εἰς αὐτὸν τουτοῒ τὸ θρυλούμενον ἰαμβεῖον,*

Γαρασδοειδὴς ὄψις ἐσθλαβωμένη.

Ἦν δὲ οὗτος Νικήτας ὁ κηδεύσας ἐπὶ θυγατρὶ Σοφίᾳ Χριστοφόρον τὸν υἱὸν τοῦ καλοῦ Ῥωμανοῦ καὶ ἀγαθοῦ βασιλέως.

[‡] STRAB. Chrestomath. III, p. 507 *Καὶ νῦν δὲ πᾶσαν Ἤπειρον καὶ Ἑλλάδα σχεδὸν καὶ Πελοπόννησον καὶ Μακεδονίαν Σκύθαι Σκλάβοι νέμονται.* 519 *Νῦν δὲ οὐδὲ ὄνομά ἐστι Πισατῶν καὶ Καυκώνων καὶ Πυλίων· ἅπαντα γὰρ ταῦτα Σκύθαι νέμονται.* In the first of these passages, Σκλάβοι may be a gloss.

in the Byzantine writers meaning simply *Northern Barbarians*. But although they did not enter Greece as conquerors, they disdained to consider themselves as subjects of the Byzantine Emperor. They enjoyed their national independence, and were a source of trouble to the government at Constantinople.* In the ninth century, the Emperor Basil, according to his son, Leo the Wise or the Philosopher, succeeded in thoroughly subjugating, Romanizing, Christianizing, and Grecizing the Slavs in his dominion. Their soldiers, being trained after the Roman system of tactics, were of essential service to the Græco-Romans. Their own princes, of course, had lost their power over them.†

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* THEOPHANES, p. 663 (A. D. 750 + 8) Τούτῳ τῷ ἔτει Κωνσταντῖνος τὰς κατὰ Μακεδονίαν Σκλαβινίας ᾐχμαλώτευσεν, καὶ τοὺς λοιποὺς ὑποχειρίους ἐποίησε. 707 (A. D. 775 + 8) Τούτῳ τῷ ἔτει εἰρηνεύσασα Εἰρήνη μετὰ τῶν Ἀράβων καὶ ἄδειαν εὑροῦσα ἀποστέλλει Σταυράκιον τὸν πατρίκιον καὶ λογοθέτην τοῦ ὀξέος δρόμου μετὰ δυνάμεως πολλῆς κατὰ τῶν Σκλαβίνων ἐθνῶν. Καὶ κατελθὼν ἐπὶ Θεσσαλονίκην καὶ Ἑλλάδα ὑπέταξε πάντας καὶ ὑποφόρους ἐποίησε τῇ βασιλείᾳ. Εἰσῆλθεν δὲ καὶ ἐν Πελοποννήσῳ καὶ πολλὴν αἰχμαλωσίαν καὶ λάφυρα ἤγαγεν τῇ τῶν Ῥωμαίων βασιλείᾳ. PORPHYROGENITUS, Cer. p. 634, 11 Χρὴ εἰδέναι ὅπως ἐδέξατο Μιχαὴλ ὁ βασιλεὺς Σκλάβους τοὺς ἀτακτήσαντας ἐν χώρᾳ τῇ Σουβδελιτίᾳ καὶ ἀνελθόντας εἰς τὰ ὄρη καὶ πάλιν καταφυγόντας τῇ αὐτοκρατορικῇ καὶ ὑψηλῇ βασιλείᾳ. . . . . Καὶ εὐθέως εἰσήχθησαν ἕτεροι Σκλάβοι Θεσσαλονίκης ἀρχοντίας, κ. τ. λ. Adm. p. 217 (A. D. 802 – 811) Νικηφόρος τὰ τῶν Ῥωμαίων σκῆπτρα ἐκράτει, καὶ οὗτοι ἐν τῷ θέματι ὄντες τῆς Πελοποννήσου ἀπόστασιν ἐννοήσαντες πρῶτον μὲν τὰς τῶν γειτόνων οἰκίας τῶν Γραικῶν ἐξεπόρθουν καὶ εἰς ἁρπαγὴν ἐτίθεντο . . . . μεθ' ἑαυτῶν ἔχοντες καὶ Ἀφρικοὺς καὶ Σαρακηνούς. 221 Καὶ πάντας μὲν τοὺς Σκλάβους καὶ λοιποὺς ἀνυποτάκτους τοῦ θέματος Πελοποννήσου ὑπέταξε [Θεόκτιστος] καὶ ἐχειρώσατο. Μόνοι δὲ οἱ Ἐζερῖται καὶ οἱ Μιληγγοὶ κατελείφθησαν ὑπὸ τὴν Λακεδαιμονίαν καὶ τὸ Ἕλος, κ. τ. λ.

† LEO, Tactic. 18, 100 Καὶ τὰ Σκλαβικὰ δὲ ἔθνη ὁμοδίαιτά τε ἦσαν καὶ ὁμότροπα ἀλλήλοις καὶ ἐλεύθερα, μηδαμῶς δουλοῦσθαι ἢ ἄρχεσθαι πειθόμενα, καὶ μάλιστα ὅτ[ε] πέραν τοῦ Δανουβίου κατῴκουν ἐν τῇ ἰδίᾳ χώρα. Ὅθεν καὶ ἐνταῦθα περαιωθέντα καὶ οἱονεὶ βιασθέντα δέξασθαι τὴν δουλείαν οὐχ ἑτέρῳ ἡδέως πείθεσθαι ἤθελον, ἀλλὰ τρόπον τινὰ ἑαυτῶν. Κρεῖττον γὰρ ἡγοῦντο ἀπὸ τοῦ ἄρχοντος τῆς ἑαυτῶν φυλῆς φθείρεσθαι, ἢ τοῖς Ῥωμαϊκοῖς δουλεύειν καὶ ὑποκλίνεσθαι νόμοις. Οἱ δὲ τοῦ σωτηρίου βαπτίσματος τὸν [φωτισμὸν?] καταδεξάμενοι ἄχρι τῶν ἡμετέρων χρόνων, τοῦτο ὅσον κατ' αὐτοὺς εἰς ἀρχαίας ἐλευθερίας συνήθειαν διατηροῦνται. The text is corrupt here. 18, 102 Ταῦτα οὖν ὁ ἡμέτερος πατὴρ καὶ Ῥωμαίων αὐτοκράτωρ Βασίλειος τῶν ἀρχαίων ἐθνῶν [read ἐθῶν] ἔπεισε μεταστῆναι, καὶ γραικώσας καὶ ἄρχουσι κατὰ τὸν Ῥωμαϊκὸν τύπον ὑποτάξας καὶ βαπτίσματι τιμήσας, τῆς δὲ δουλείας ἠλευθέρωσε τῶν ἑαυτῶν ἀρχόντων καὶ στρατεύεσθαι κατὰ

With regard to the Slavs of Peloponnesus, Porphyrogenitus informs us that those who occupied the slopes of the Pentadactylus (the mediæval name of the Taÿgetus) were called Ἐζερῖται and Μιληγγοί.[*] The word Ἐζερῖται means simply *natives of* Ἐζερόν, the mediæval name of Ἕλος; *ἔζερο* (neuter) in Slavic meaning *lake*, and in this case applying to the *lake* or *swamp* (ἕλος) in the vicinity of the ancient Ἕλος. As to Μιληγγοί, it is analogous to the ancient word Λεοντῖνοι, that is, it applies both to the place and to the people inhabiting it. In the "Book of the Conquest of the Morea by the Franks," this place is called Μελιγγοί or Μελιγοί, or in the singular Μελιγγόν or Μελιγόν.[†] The same book uses also τὰ Σκλαβικά, *the Slavic settlements*, and τῶν Σκλαβῶν ὁ δρόγγος, *the district of the Slavs*, with reference to the Slavs of Laconia.[‡] The neuter τὸ Μελιγόν occurs once in Phrantzes, an author of the fifteenth century.[§] These Slavs are represented as an arrogant and refractory people. "They have no respect for masters," says the "Book of the Conquest of the Morea by the Franks."[‖]

τῶν Ῥωμαίοις πολεμούντων ἐθνῶν ἐξεπαίδευσεν οὕτω πως ἐπιμελῶς περὶ τὰ τοιαῦτα διακείμενος. Διὸ καὶ ἀμερίμνους Ῥωμαίους ἐκ τῆς πολλάκις ἀπὸ Σκλάβων γενομένης ἀνταρσίας ἐποίησε· πολλὰς ὑπ' ἐκείνων ὀχλήσεις καὶ πολέμους τοῖς πάλαι χρόνοις ὑπομείναντας.

If *γραικώσας*, *having Grecized*, is not a corrupt reading, it is formed from *γραικόω*, *to make* one *Γραικός*, after the analogy of *σθλαβόω*, from Σθλάβος. See *σθλαβόω*, in the Glossary of Later and Byzantine Greek, and compare *ἐκδεδωρίευνται* (from *ἐκδωριεύομαι*, a compound of *ἐκ* and Δωριεύς) in Herodotus (8, 73).

[*] See above, p. 301.

[†] CONQUEST, 1666 *Ὅτι ὁ ζυγὸς τῶν Μελιγγῶν ἔνι γὰρ δρόγγος μέγας*, *For the ridge of Melingi is a large district.* 3205 *Τῶν ἀρχηγῶν ἐμήνυσαν τῶν Μελιγγῶν τοῦ δρόγγου*, equivalent to *Ἐμήνυσαν τῶν ἀρχηγῶν τοῦ δρόγγου τῶν Μελιγγῶν.* 386 *Ἐκ τῶν ζυγῶν τῶν Μελιγῶν ἦλθαν τὰ πεζικά τους.* 1671 *Ὅτι ἀφότου ἐγείνετον τοῦ Μιζιθρᾶ τὸ κάστρον Καὶ ἔνι ἀπάνω εἰς τὸν ζυγὸν τοῦ Μελιγγοῦ τὸν δρόγγον.* 3262 *Εἰς τὸν δρόγγον γὰρ τοῦ Μελιγοῦ ὁμοίως τῆς Τζακωνίας.*

[‡] IBID. 1713. 3279.

[§] PHRANTZES, p. 159 Μελίγον.

[‖] CONQUEST, 1666 *Ὅτι ὁ ζυγὸς τῶν Μελιγῶν ἔνι γὰρ δρόγγος μέγας, Καὶ ἔχει κλεισούραις δυναταῖς, χώραις γὰρ καὶ μεγάλαις, Ἀνθρώπους ἀλαζονικοὺς κ' οὐ σέβονται αὐθέντην.* In this poem, *γάρ* is often introduced simply to fill out the line.

And from Porphyrogenitus we learn that the 'Εζερῖται and the Μιληγγοί were the last to submit to the government at Constantinople.[*]

According to an anonymous writer of the fourteenth century, Peloponnesus was at that time inhabited by a mongrel population, the principal elements being Lacedæmonians, Italians, Peloponnesians, Slavs, Illyrians, Egyptians, and Jews.[†] By *Lacedæmonians* and *Peloponnesians* he must mean the modern Μανιᾶτες and Μωραῖτες. His *Illyrians* are our 'Αρβανῖτες. As to his Αἰγύπτιοι, they are most probably the Γύφτοι, Gypsies, of the present day, who are currently believed in the Levant to be of Egyptian origin, perhaps because the Gypsies who first appeared among the Greeks came from Egypt. It is possible, however, that this writer's Egyptians may be the descendants of the Saracens and the Africans, who, conjointly with the Slavs, were plundering the Greeks of Peloponnesus in the early part of the ninth century, as Porphyrogenitus informs us.[‡]

It is sometimes asked, what became of the language of the Grecized Slavs? If the modern Greeks are Slavs, why is not Greece now another Servia or Bosnia? For although the Slavic language has left behind it a number of names of places,[§] and tinctured the Greek with some of its own formative endings, it is not now spoken in any part of Greece. Questions of this sort can be asked only by those who are but imperfectly acquainted with the history of mediæval Greece. Such persons seem to forget that language, as expressive of ideas, is, as it were, an artificial thing; and consequently one race may adopt the language of another; and, what is more remarkable, the same race changes its language constantly, and usually by an endogenous process, so to speak. The argument from language, therefore, is of no weight, when it is opposed to direct historical evidence. The preservation of the Greek language would indeed be an extraordinary phenomenon, if we assumed that the Greek race ceased to exist after the great plague in the eighth century. "Languages," says a distinguished linguist,* "adhere so tenaciously to their native soil, that, in general, they can be eradicated only by the extirpation of the races that speak them." The vitality or tenacity of the Greek language is too well known to require any comments here.

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[*] See above, p. 301.

[†] BOISSONADE'S ANECD. GRÆC. III, p. 174 'Εν Πελοποννήσῳ, ὡς καὶ αὐτὸς οἶδας, ξεῖνε, οἰκεῖ ἀναμὶξ γένη πολιτευόμενα πάμπολλα, ὧν τὸν χωρισμὸν εὑρεῖν νῦν οὔτε ῥᾴδιον οὔτε κατεπεῖγον. Ἃ δὲ ταῖς ἀκοαῖς περιηχεῖται, ὡς πᾶσι δῆλα καὶ κορυφαῖα, τυγχάνει ταῦτα· Λακεδαίμονες, 'Ιταλοὶ, Πελοποννήσιοι, Σθλαβῖνοι, 'Ιλλυριοὶ, Αἰγύπτιοι καὶ 'Ιουδαῖοι, οὐκ ὀλίγοι δὲ μέσον τούτων καὶ ὑποβολιμαῖοι· ὁμοῦ τὰ τοιαῦτα ἐπαριθμούμενα ἑπτά. A poor imitation of HERODOTUS, 8, 73 Οἰκέει δὲ τὴν Πελοπόννησον ἔθνεα ἑπτά.

The Μάζαρις of this unknown author seems to be an imaginary person, suggested perhaps by the *Er* (Ἦρ) of PLAT. Rep. 10, p. 614 B 'Αλλ' οὐ μέντοι σοι, ἦν δ' ἐγὼ, 'Αλκίνου γε ἀπόλογον ἐρῶ, ἀλλ' ἀλκίμου μὲν ἀνδρὸς, 'Ηρὸς τοῦ 'Αρμενίου, τὸ γένος Παμφύλου· ὅς ποτε ἐν πολέμῳ τελευτήσας, ἀναιρεθέντων δεκαταίων τῶν νεκρῶν ἤδη διεφθαρμένων, ὑγιὴς μὲν ἀνῃρέθη, κ. τ. λ.

[‡] See above, p. 301.

[§] Examples: Γούρα, ας, ἡ, *Ghúra*, the ancient Ὄρθυς; from the Slavic γορὰ, *mountain* (ὄρος). Γορίτζα, ας, ἡ, *Ghoritza*, the site of the ancient Δημητριάς; from γορίτζα, the diminutive of the Slavic γορὰ, because it is *a little mountain*, as compared with Pelion. Ζαγορά, ᾶς, ἡ, *Zaghorá*, a town behind Pelion with respect to Volo; from the Slavic ζα, *behind*, *back*, and γορὰ. Ζαγόρι, ιοῦ, τὸ, *Zaghóri*, a town in Epirus; from the Russian ζα-

But the Greek race was not extirpated by the great plague. There is sufficient historical evidence that the Greeks (οἱ Ἑλλαδικοί) did not entirely disappear during the eighth century. Thus, Saint Nicephorus the Confessor says that, as Constantinople was all but depopulated by the plague, it became necessary to replenish it with people brought from the continental parts of the empire and from the islands.† And there is no proof that these new Constantinopolitans did not speak Greek as their vernacular tongue. Again, Porphyrogenitus tells us that when the Slavs of Peloponnesus rebelled against the government in the reign of Nicephorus, nearly two generations after the plague, they plundered the houses *of the Greeks* (τῶν Γραικῶν) in their vicinity.‡ In another place he observes that the inhabitants of Μαΐνη, a fortified town near Tænarum, were not Slavs; they were descended from the earlier Romans (and by *Romans* he means *Greeks*). In his time they

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γόρε (neuter), *a place behind a mountain.* Κάρλας, α, ὁ, *Kárlas*, the ancient Βοιβηΐς; from the Russian κάρλα, *a dwarf*, because the Kárlas is *a little sea* or *lake?*

* GEORGE P. MARSH, *Lectures on the English Language*, p. 25.

† NICEPHORUS CONSTANTINOPOLITANUS, p. 72 Ἐντεῦθεν τοίνυν ἀνοίκητον σχεδὸν ἤδη γεγονυῖαν τὴν πόλιν ταύτην κατοικίζει ἐκ τῶν χωρῶν καὶ τῶν νήσων τῆς ὑπὸ Ρωμαίοις ἐξουσίας λαῶν πλήθη μετάγων.

‡ See above, p. 301.

were called Ἕλληνες by their neighbors, because they continued to worship idols as late as the time of his grandfather Basil;[*] Ἕλληνες in Hebraistic and Byzantine Greek being usually equivalent to *gentiles, heathens, idolaters.* Now it cannot be easily believed that the Greeks mentioned by these authors were the only Greeks in existence at that time.

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[*] PORPHYROGENITUS, Adm. p. 224 Ἰστέον ὅτι οἱ τοῦ κάστρου τῆς Μαῗνης οἰκήτορες οὐκ εἰσὶν ἀπὸ τῆς γενεᾶς τῶν προρρηθέντων Σκλάβων, ἀλλ' ἐκ τῶν παλαιοτέρων Ρωμαίων· οἳ καὶ μέχρι τοῦ νῦν παρὰ τῶν ἐντοπίων Ἕλληνες προσαγορεύονται, διὰ τὸ ἐν τοῖς προπαλαιοῖς χρόνοις εἰδωλολάτρας εἶναι καὶ προσκυνητὰς τῶν εἰδώλων κατὰ τοὺς παλαιοὺς Ἕλληνας. Οἵτινες ἐπὶ τῆς βασιλείας τοῦ ἀοιδίμου Βασιλείου βαπτισθέντες χριστιανοὶ γεγόνασιν. Ὁ δὲ τόπος ἐν ᾧ οἰκοῦσίν ἐστιν ἄνυδρος καὶ ἀπρόσοδος, ἐλαιοφόρος δέ· ὅθεν καὶ τὴν παραμυθίαν ἔχουσι. Διάκειται δὲ ὁ τοιοῦτος τόπος εἰς ἄκραν τοῦ Μαλέα [write Ταινάρου], ἤγουν ἐκεῖθεν τοῦ Ἐζεροῦ πρὸς παραθαλασσίαν.

In this extract, for Μαλέα we must read Ταινάρου, which is *beyond* (ἐκεῖθεν) Ezeron, with respect to Constantinople, the author's residence. According to the "Book of the Conquest of the Morea by the Franks," Μαῗνη stood near the celebrated cave of Tænarum. Several centuries after the age of Porphyrogenitus, the French erected a fort in the vicinity of this cave, and named it Μαῗνη, Μάϊνη (in two syllables), or Μάνη. From which it would appear that, in the thirteenth century, of the Μαῗνη of Porphyrogenitus only the name remained. CONQUEST, 1677 Καὶ ἐπέρασε τὸν Πασαβᾶν καὶ ἐδιέβη εἰς τὴν Μάϊνην· Ἐκεῖ ηὗρε σπήλαιον φοβερὸν εἰς ἀκρωτήρι ἀπάνω. Διατὶ τοῦ ἄρεσε πολλὰ, ἐποίησεν ἕνα κάστρον, Καὶ Μάϊνην τὸ ὠνόμασε, οὕτω τὸ λέγουν πάλιν. 1711 Καὶ ἀφότου γὰρ ἐκτίσθησαν τὰ κάστρη ὁποῦ σὲ εἴπω, Τὸ Λεῦτρον καὶ τ[οῦ] Μιζιθρᾶ καὶ τῆς παλαιᾶς Μαῗνης: perhaps the true reading is μεγάλης Μάϊνης. 3004 Τὸ κάστρον τῆς Μονοβασιᾶς καὶ τῆς μεγάλης Μάϊνης. 3174 Ἐδιέβη εἰς τὸν Μιζιθρᾶν, αὐτὸν ἐδῶκε πρῶτον, Ἀπέκει τὴν Μονοβασιὰν, καὶ τρίτον δὲ τὴν Μάνην. PACHYMERES, I, p. 88, 4 Μονεμβασίαν, Μαῗνην, Ἱεράκιον, κ. τ. λ. NICEPHORUS GREGORAS, I, p. 80, 1 Τήν τε Μονεμβασίαν καὶ τὴν περὶ τὰ Λεῦκτρα Μαίνην (write Μαῗνην), ἣ Ταιναρία πάλαι παρ' Ἕλλησιν Ἄκρα ἐκαλεῖτο. PHRANTZES, p. 17, 10 Τὰ Λεῦκτρα Μαῗνης, ἣ καὶ Ταιναρία πάλαι Ἄκρα ἐκαλεῖτο παρ' Ἕλλησι. Incorrectly copied from the preceding passage. 131, 1 Τὸ Λεῦκτρον Μαῗνης, τὸ ὁποῖον Κεταρία (write Ταιναρία) πάλαι [Ἄκρα] ἐκαλεῖτο. 133, 5 Ἀνδροῦσα λέγω καὶ Καλαμάτα, Μαντίνεια, Ἰάννιτζα, Πίδημα (write Πήδημα) καὶ Μάνη καὶ Νησὶν καὶ Σπιτάλιν καὶ Γρεμπενὴ καὶ Ἀετὸς καὶ Νεόκαστρον, κ. τ. λ. 391, 4 Τὸ Λεῦκτρον καὶ τὸ πολὺ τῆς Μάνης ζυγόν, *The ridge of Mane.*

At present the name Μάνη is applied to a district comprised in the ancient Laconia, and including the ruins of the Byzantine and the French Μαῗνη.

It appears, then, that when the Slavs entered Greece, in the eighth century, there were Greeks enough left to absorb the Slavic element, and to serve as a nucleus for the new race, — the Greeks of the later empire, and the progenitors of the modern Greeks. Of course, the proportion of the Slavs to the Greeks cannot be determined with any degree of certainty.

It may be well to mention here the curious fact that the French, who held possession of Peloponnesus in the thirteenth century, had no doubt that those who spoke Greek were the descendants of the ancient Greeks. "A great while ago," said one of them, "these Romans were called Ἕλληνες. They were an arrogant nation, and still are so. Their present name comes from Rome. And because of their arrogance and superciliousness, they have abandoned the ritual of the Church of Rome, and pride themselves upon being schismatics."[*] The speaker, however, was a better fighter than historian or theologian. He was not aware of the fact that the Greeks had lost their national consciousness, together with their ancient religion, in the seventh century, after which time they regarded themselves not as Hellenes and heathens, but as Romans and Christians. And as to their ancient appellation (Ἕλληνες), it was usually employed as a term of obloquy. To infer from language the identity of a modern with an ancient nation, it is necessary to prove historically that that nation never had any other language since its first appearance on earth.

When the Emperor Basil is said to have Romanized, Christianized, and Grecized his Slavic subjects, in the ninth century, we are not to suppose that he interdicted the Slavic tongue, and thus forced those whose vernacular it was to use the Greek. We are only to remember that the Slavic, when it came in contact with the Greek, was a barbarous language, an unwritten language, an uncultivated language, and, under ordinary circumstances, incapable of resisting the encroachments of its powerful neighbor, which, in addition to its full development and rich literature, had the advantage of being the language of the Emperor and of the imperial city, of the clergy, of the provincial governors, military commanders, judges, lawyers, physicians, schoolmasters (such as they were), merchants, and, above all, of the ritual of the Greek Church. The disappearance of the Slavic from Greece is by no means a singular phenomenon. The Latin forced itself upon the Dacians, and upon the greater part of the Celtic race; the Egyptians and Syrians adopted the language of the Koran, the sacred book of their conquerors, the Saracens. And it may be added here, that the Tzákones and Albanians of Greece will probably, in less than two generations, speak good Modern Greek as their native tongue, if education in that country continues to advance at its present rate. It would seem further, that the Slavs began to learn Greek before the time of Basil. Thus, in the reign of Copronymus (in the eighth century) we find a Sclavonian eunuch filling the œcumenical see of Constantinople. This dignitary, however, was not remarkable for his scholarship, his forte being eating and drinking, according to Glycas.*

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[*] CONQUEST, Prolog. 794 Διαβάντες γὰρ χρόνοι πολλοὶ αὐτῆνοι οἱ Ρωμαῖοι Ἕλληνες εἶχαν τὸ ὄνομα (*avaient du nom*) οὕτως τοὺς ὠνομάζαν. Πολλὰ ἦσαν ἀλαζονικοὶ, ἀκόμη τὸ κρατοῦσιν. Ἀπὸ τὴν Ρώμην ἐπήρασιν τὸ ὄνομα τῶν Ρωμαίων. Ἀπ' αὕτης τῆς ἀλαζονείας τὴν ἔπαρσιν ὁποῦ εἶχαν Ἀφήκασιν τὸν ὄρδιναν τῆς ἐκκλησίας τῆς Ρώμης, Καὶ στέκουν ὡς ἰσμάτικοι, μόνοι τὸ καῦχο ἔχουν.

An anecdote preserved by Porphyrogenitus seems to imply that the Græco-Slavs of Peloponnesus prided themselves upon their lineal descent from the ancient Greeks, because they spoke Greek and went to the Greek Church, although their features sufficiently showed the predominance of the Slavic element.†

If we now suppose that, from some cause or other, the barbarians who occupied Cynuria after the disappearance of the original population, found it easier to lose their original tongue than to learn Greek as spoken by the Greeks, we have a plausible or probable solution of the dialect of Tzakoniá. The hypothesis that it is a remnant of the ancient Doric or Pelasgic is too fantastic to merit any serious consideration. It may not be amiss to state here, that all the Byzantine writers of whom we have any knowledge are silent on the subject of the Tzakonic dialect, properly so called.*

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* THEOPHANES, p. 680, 7 Ψήφῳ τοῦ βασιλέως χειροτονεῖται Νικήτας ὁ ἀπὸ Σκλάβων εὐνοῦχος ἀθέσμως πατριάρχης Κωνσταντινουπόλεως. GLYCAS, p. 527, 13 Καὶ τότε Νικήτας τις εὐνοῦχος τὰ πρῶτα φέρων παρὰ τῷ Κοπρωνύμῳ μηδὲν ἄλλο εἰδὼς ἢ ἐσθίειν καὶ πίνειν χειροτονεῖται πατριάρχης. Οὗτός ποτε τὸ εὐαγγέλιον ἀναγινώσκων ἐν τῷ κελλίῳ αὐτοῦ ἀντὶ τοῦ εἰπεῖν Ἐκ τοῦ κατὰ Ματθαῖον, Ἐκ τοῦ κατὰ Ματθάϊον ἐξεφώνησεν. Ἐφ᾽ ᾧ καί τις τῶν παρισταμένων εἶπε, Μὴ διαίρει τὴν ΑΙ δίφθογγον. Πρὸς ὃν ἐκεῖνος ἔφη μετὰ θυμοῦ, Φλυαρεῖς· τὰ γὰρ δίφθογγα καὶ τρίφθογγα πολλὰ μισεῖ ἡ ψυχή μου. The full form of the sentence preceding the gospel of the day, when it is found in Matthew, is Ἐκ τοῦ κατὰ Ματθαῖον ἁγίου εὐαγγελίου τὸ ἀνάγνωσμα, sc. ἐστί. If the gospel is found in Mark, we have Ἐκ τοῦ κατὰ Μάρκον, and so on. The words δίφθογγα and τρίφθογγα are used by the author of the anecdote in allusion to the patriarch's being ἐκτετμημένος.

† See above, p. 300.

Nothing satisfactory has been proposed in relation to the etymology of the word Τζάκωνες, the name of the inhabitants of Τζακωνία or Τζακωνιά. It occurs for the first time in authors of the fourteenth century. Pachymeres, Gregoras, and the anonymous writer already alluded to, regard it as a corruption of Λάκωνες; and naturally enough confound the modern Tzákones with the ancient Lacones.† It must be borne in mind, however, that Byzantine etymologists unsupported by higher authority are entitled to little or no credit. Pedants capable of deriving Γραικός from Γράνικος‡ will have no difficulty in forming Τζάκωνες from Λάκωνες, Καύκωνες, or Κίκονες. The Tzákones of the above-mentioned authors are apparently the modern Μανιᾶτες. According to Curopalates, a writer probably of the fourteenth or fifteenth century, the name Τζάκονες was used at Constantinople in the sense of *garrison*.§

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* For Tzakonic words and inflections, and ingenious speculations concerning the origin of this dialect, see LEAKE's *Researches in Greece*, p. 196 (London, 1814). *Travels in the Morea*, Vol. II. p. 505 (London, 1830). *Peloponnesiaca*, p. 304 (London, 1846). THIERSCH's Article on the Tzakonic Dialect, in the *Transactions of the Royal Academy of Sciences at Munich*, 1832.

† PACHYMERES, I, 309 ͵Ἄλλοι τε πλεῖστοι ἐκ τῶν Λακώνων, οὓς καὶ Τζάκωνας παραφθείροντες ἔλεγον, οὓς ἔκ τε Μορέου καὶ τῶν δυσικῶν ἅμα μὲν πολλοὺς, ἅμα δὲ καὶ μαχίμους ἅμα γυναιξὶ καὶ τέκνοις εἰς Κωνσταντινούπολιν μετῴκιζεν ὁ κρατῶν [Michael Palaeologus]. NICEPH. GREGORAS, I, 98, 10 Συνῆν δὲ τούτοις καὶ στρατὸς ἐν τοῖς ὅπλοις θαλάττιος, Λάκωνες ἄρτι προσελθόντες ἐκ Πελοποννήσου τῷ βασιλεῖ, οὓς ἡ κοινὴ παραφθείρασα γλῶσσα Τζάκωνας μετωνόμασεν. BOISSONADE's ANECD. GRÆC. III, p. 164 Βεβαρβάρωνταί γε οἱ Λάκωνες καὶ νῦν κέκληνται Τζάκωνες.

‡ PORPHYROGENITUS, Them. 1, 4, p. 25, 9 Τὰ δὲ πρὸς τὴν θάλασσαν καὶ τὴν Κύζικον κατοικοῦσι Φρύγες τε καὶ Γραικοὶ, ἀπὸ τοῦ ποταμοῦ Γρανίκου τὴν ὀνομασίαν πλουτήσαντες.

§ CUROPALATES, p. 12, 4 Ὁ στρατοπεδάρχης τῶν Τζακόνων (sic). 27, 5 Τοῦ στρατοπεδάρχου τῶν Τζακόνων. 37, 10 Εἶτα εὑρίσκονται (*se trouvent*) οἱ ὀνομαζόμενοι Τζάκονες φέροντες καὶ οὗτοι πιλατίκια. 42, 18 Ὁ στρατοπεδάρχης τῶι Τζακόνων ἐπιμελεῖται τῶν εἰς τὰ κάστρα εὑρισκομένων (*qui se trouvent*) φυλάξεων, οἵτινες Τζάκονες ὀνομάζονται.

In a work attributed to Porphyrogenitus, Τζέκωνες (with an E) corresponds to the Τζάκονες of Curopalates.[*] The "Book of the Conquest of the Morea by the Franks," the author of which seems to be well acquainted with the topography of Peloponnesus, always distinguishes between Τζακωνία or Τζακωνιά and the different parts of Laconia.[†] And there is no reason for supposing that its Tzakoniá did not comprise the Tzakoniá of the present day.

It will be asked, also, If the majority of the continental and peninsular Greeks are essentially Grecized Slavs, do they resemble physically and mentally the acknowledged Slavs of Turkey and Austria? Is there no external difference between the Servians, for instance, and the present inhabitants of Peloponnesus? In order to answer this simple question, it must be first observed that there are many varieties of modern Greeks, although the species is sufficiently distinct. Assuming that most of the Greek islanders are the best representatives of the ancient Greek stock, it may safely be said that the Greek type is not often to be met with among the *lowlanders* of continental and peninsular Greece. Many of them may be taken for Southern Slavs, and many more for Albanians. In fact, the bulk of the rural population of Argolis, Megaris, and Attica is confessedly Albanian. On the other hand, many Southern Slavs may pass for continental Greeks, if they happen to speak Modern Greek with sufficient accuracy. In short, the modern Greeks are not a homogeneous people. And here the over-curious will ask further, Were all the ancient Greeks alike? Was there no physiological difference between the Dorians and Macedonians? Could the Dolopes and Dryopes be easily distinguished from the Ionians or the Thessalians? How much resemblance was there between the Hellenes and the surrounding barbarians? Questions like these cannot be satisfactorily answered at the present day. The following facts, however, seem to bear upon this point.

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[*] PORPHYROGENITUS, Cer. 696, 7 Ἐξ ὧν καὶ Τζέκωνες ἀφορίζονται εἰς τὰ κάστρα.

[†] CONQUEST, 610 Ἕξη φίε (*fiefs*) τοῦ ἐδόθησαν νὰ ἔχῃ 's τὴν Τζακωνίαν. 736 Τὸ μέρος γὰρ τῆς Τζακωνιᾶς καὶ μέχρι εἰς τὸ Ἕλος Καὶ ἐκεῖσε εἰς τὰ Βατικὰ καὶ εἰς τὴν Μονοβασίαν Ἐνταῦθα ἦλθαν οἱ ἄρχοντες τῆς Λακοδαιμονίας (sic), Ὡσαύτως γὰρ τοῦ Ἀμυκλίου ὁποῦ εἶχαν ταὶς προνοίαις τους (*feuds*, *fiefs*, *fees*), Ἐκεῖσε εἰς τὴν Τζακωνιάν. 3279 Ἡ Τζακωνιὰ, τὰ Βατικὰ, καὶ τῶν Σκλαβῶν ὁ δρόγγος. 4288 Ἔδραμαν τὰ φουσάτα του τὰ Βάτικα, τὸ Ἕλος, Καὶ μέχρις 's τὴν Μονοβασιὰν ἐκούρσεψαν τὸν τόπον· Ἀπαύτου τὸν Γαρδάλεβον καὶ ὅλην τὴν Τζακωνίαν.

When Xerxes was on his way to Greece, some Greek spies were sent to Sardis, the capital of Lydia, to observe the movements of his army.* This simple incident implies either that a Greek could not be easily distinguished from an Asian, and therefore the Greek spies ran no risk of being detected by their features; or that many Greeks might easily be taken for Lydians, Phrygians, Mysians, Carians, and so forth. Had there been any marked difference between the Greeks and the nations of Asia Minor, these men would not have ventured upon such an undertaking. It may be said, however, that the Persians might have taken them for Ionians, in which case they would not have molested them, since the Asiatic Ionians at that time were compelled to side with the great king.

Again, when the Greek army under Xenophon were deliberating, in the vicinity of Babylon, about their return to Greece, a Lydian spy in the employ of the Persians, calling himself Apollonides, and speaking the Bœotic dialect, endeavored to persuade the Greeks to surrender to the king. Most of the commanders, it would seem, took him for a Greek, and told him that he was a disgrace to Greece for proposing such a cowardly measure. "I warrant you he is not a Greek," exclaimed Agasias; "he is a Lydian, for his ears are bored"; — which implies that the Lydians were in the habit of wearing ear-rings, a practice discountenanced by the Greeks.†

During the most flourishing period of Athens, supposititious children were not uncommon; the Athenian matrons sometimes exchanging babes with their female slaves, if the infant of the slave was a boy, and that of the mistress a girl. Occasionally the lady would buy a newly born child from some slave, and make her husband believe that she was its true mother, and he its true father.‡ Now the slaves of

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* HER. 7, 145 seq.

† XEN. ANAB. 3, 1, 26 (17) seq. Compare DION CHRYSOSTOM. Or. 32, p. 654, ear-rings worn by Lydian and Phrygian girls and boys.

‡ EUR. Alc. 647 Οὐκ ἦσθ' ἄρ' ὀρθῶς τοῦδε σώματος πατὴρ, Οὐδ' ἡ τεκεῖν φάσκουσα καὶ κεκλημένη Μήτηρ μ' ἔτικτε· δουλίου δ' ἀφ' αἵματος Μαστῷ γυναικὸς σῆς ὑπεβλήθην λάθρᾳ. ARIST. Thesm. 570 Οὐδ' ὡς σὺ, τῆς δούλης τεκούσης ἄρρεν' εἶτα σαυτῇ Τοῦθ' ὑπεβάλου, τὸ σὸν δὲ θυγάτριον παρῆκας αὐτῇ. 508 'Ετέραν δ' ἐγῷδ', ἣ 'φασκεν ὠδίνειν γυνή Δέχ' ἡμέρας, ἕως ἐπρίατο παιδίον.

Athens, as a rule, were not Greeks; they were barbarians, such as Phrygians, Carians, Thracians. And yet their children could not be distinguished from those of the descendants of the Autochthones. The obvious inference is, either that there was no great difference between the exterior of the Hellenes and that of the neighboring races, or that many barbarians might be taken for Greeks, and many Greeks for barbarians.

Professor Bond exhibited a diagram of the outline of the head of the great Comet of 1858, compared with a parabola having its focus at the nucleus, and its axis coincident with the initial axis of the tail, the curve touching the outline at its apex.

In this position the two curves should coincide, if we suppose the paths of the particles forming the tail, after being emitted with equal initial velocity in all directions from the nucleus, to be determined by the repulsive force of the sun, alone, or in conjunction with a repulsion from the nucleus, sensible only at a small distance from it.*

The Plate represents a group of normal outlines of the head of the Comet, with the position of the nucleus corresponding to each, determined from actual observations for the dates September 17 and 30, and October 7 and 14, 1858. The second group shows the curve of a parabola having its focus at the nucleus, and enclosing the normal outline of the Comet on October 4, with the curve of a catenary imposed upon it. The approximation of the latter to the outline of the Comet is remarkable. On the other hand, the divergence of the parabola is decided, and shows the necessity of some modification of the above hypotheses.

The existence of an atmosphere holding the particles in suspension previously to their being driven off into the tail would tend to contract its outline, and afford in this particular a nearer agreement with the observed figure; a similar effect would be produced if we suppose the initial velocity of the particles, on leaving the vicinity of the nucleus, to diminish when the angle between the direction of emission and that of the sun increases; or, again, if the direction of emission from the nucleus is limited to a comparatively small range on either side of the sun.

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* Bredichin, Astron. Nach. 1291, p. 292. Norton, Am. Jour. of Science, XXVII. p. 87; XXIX. p. 384.

The observed outlines of the head of the Comet have been obtained by tracing the curve of the outer edge, and the place of the nucleus, upon slips of mica laid over the original drawings. The curves were then collected in groups and reduced to a common scale, and finally combined in normals. On comparing the groups, it was found that there was scarcely any change in the character of the apparent outline during the interval from August 24 to November 12, covered by the observations. From this it would seem that there was an actual change in the figure of the Comet itself, since the alteration of the inclination of the axis to the line of vision, which intervened, must otherwise have occasioned a considerable variation in the apparent figure, due to perspective foreshortening.

The original number of groups was six, subsequently reduced to four normals, as represented on the plate. At the date of the normal for September 30, the day of perihelion passage, the apparent figure was nearly that afforded by a section through the axis of the tail.

The drawings employed were made at the following places: —

Copenhagen,	wt. = 3.	Aug. 24, 31; Sept. 3, 23, 26, 28, 29, 30; Oct. 1, 5, 6.
Munich,	wt. = 2.	Oct. 3, 4, 7, 10, 14, 16, 18.
Markree,	wt. = 3.	Sept. 20, 28; Oct. 4, 5, 7, 8, 11, 16.
Altona,	wt. = 2.	Sept. 22, 28; Oct. 1, 4, 6, 9, 12.
Dessau,	wt. = 1.	Oct. 4, 10.
Rome, Collegio Romano,	wt. = 1.	Sept. 4, 11, 16, 22, 29; Oct. 2, 4, 8, 9, 11, 13, 15, 17, 18, 19, 22.
Melbourne, Australia,	wt. = 2.	Oct. 12, 13, 14, 24; Nov. 7, 12.
Poulkova,	wt. = 3.	Sept. 12, 16, 18, 22, 24, 25, 30; Oct. 5, 7, 8, 9, 13.
Cambridge, England,	wt. = 2.	Sept. 27, 30; Oct. 2, 5, 6, 8, 9, 11, 15, 16.
Haddenham, England,	wt. = 3.	Sept. 24; Oct. 5, 8, 11, 17.
Greenwich, England,	wt. = 3.	Oct. 2, 3, 4, 5, 9, 11, 15.
Hamilton College, N. Y.,	wt. = 3.	Oct. 7, 10, 15, 17.
Bradstones, Liverpool, Eng.,	wt. = 3.	Sept. 12; Oct. 3, 4, 5, 8.
Observatory of Harv. Coll.,	wt. = 3.	Sept. 8, 20, 24, 25, 28; Oct. 2, 6, 8, 9, 10, 11, 15, 18, 19.
Geneva,	wt. = 2.	Sept. 26; Oct. 3, 5, 6, 7, 9, 13, 14, 15.

A similar deviation from the parabolic figure is presented in the outlines of the head of the Comet of July, 1861, and in numerous other instances. The strongest case of divergence occurs in the singularly well-defined contour of the external envelope of the Comet of June, 1860.

Five hundredth meeting.

November 13, 1861. — STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read various letters of acknowledgment of the reception of recent publications of the Academy.

The President presented a letter from the Standing Committee of the Boston Athenæum, offering a renewal of the lease held by the Academy for three years ensuing. Voted, that the Finance Committee be empowered to renew the lease upon the terms offered.

Professor Eustis having declined to serve upon the Rumford Committee, Professor William B. Rogers was nominated and appointed to fill the vacancy.

Jules Marcou, of Boston, was elected a Fellow of the Academy, in Class II. Section 1.

Ezra Abbot, of Cambridge, in Class III. Section 2.

Truman H. Safford, of Cambridge, in Class I. Section 2.

Hon. Benjamin F. Thomas, in Class III. Section 1.

Chief Justice George T. Bigelow, of Boston, in Class III. Section 1.

The following, nominated by the Council, were elected Associate Fellows: —

J. M. Gilliss, U. S. N., Director in charge of the Naval Observatory, Washington, in Class I. Section 2.

J. M. Ordway, of Manchester, New Hampshire, in Class I. Section 3.

Professor James Hadley, Jr., of Yale College, in Class III. Section 2.

Dr. F. S. Holmes, of Charleston, South Carolina, in Class II. Section 1.

The following, nominated by the Council at the Annual Meeting, were elected Foreign Honorary Members: —

Professor Bekker, of Berlin, in Class III. Section 2.

Professor Trendelenberg, of Berlin, in Class II. Section 1.

Captain Duperrey, of Paris, in Class II. Section 1.

Professor Peirce read a paper by Captain Anderson, of the British Mail Steamer Canada, upon a general plan of education for seamen, and their training in making scientific observations and collections. The advice and co-operation of the Academy being requested, a committee on the subject was appointed, consisting of Messrs. J. I. Bowditch, Felton, Agassiz, Rogers, Peirce, Lovering, A. Gray, J. Wyman, and C. W. Eliot.

Professor Agassiz presented a paper, entitled, Contributions to the Natural History of the Acalephs of North America.

Professor Bowen read the second and concluding portion of a paper On Specie Reserves and Bank Deposits.

Professor Gray presented the following communications, viz.: —

1. *Notes upon a Portion of Dr. Seemann's recent Collection of Dried Plants gathered in the Feejee Islands. By* ASA GRAY.

Dr. Berthold Seemann, who, as the naturalist of a former expedition in the Pacific of the British surveying ship Herald, had acquired a high reputation in scientific exploration, has recently visited the Feejee Islands, under a commission from the British government, to examine the productive resources and capabilities of that interesting group of islands. While attending to this duty he was able to gather specimens of above eight hundred and fifty species of dried plants; and a list of them, with such determinations as he could hastily make, was published by him, in the number for the 15th of September last of the well-known botanical periodical, the Bonplandia, of which Dr. Seemann is the editor. It being very desirable that this collection should be critically compared with that made by the Pacific Exploring

Expedition under Captain Wilkes, the Phænogamous portion of which has mainly been elaborated by me, Dr. Seemann kindly communicated to me as full a set as possible of the plants he collected. Having collated the portion belonging to the orders which have been elaborated and published by me, I here offer some brief notes upon that portion of Dr. Seeman's collection, — following the order of his list, and mentioning only those species which suggest some remark.

No. 4. "*Polyalthia Vitiensis*, Seem." was not supplied to me; and, on the other hand, Dr. Seemann does not enumerate my *Richella monosperma* nor *Uvaria amygdalina*.

12. "*Agatea violaris*, A. Gray," is the var. β of this interesting species, a form with still broader leaves.

23. "*Hibiscus Storckii*, Seem." appears not to be sufficiently distinct from *H. Rosa-Sinensis*.

24. "*Paritium purpurascens*, Seem." The living plants may furnish good characters to distinguish this from *P. tiliaceum*, but they are not apparent in the dried specimen supplied.

39. "*Grewia Mallococca*, Linn. f." The specimen accords with *G. persicæfolia*, Gray, Bot. Expl. Exped., which, however, may be only a variety of Forster's species.

41. "*Trichospermum Richii*, Seem." = *Diclidocarpus Richii*, Gray, l. c., Mr. Bentham having shown that the latter belongs to Blume's little-known genus, which was wrongly placed in the *Flacourtiaceæ*, and so overlooked.

45. "*Ternstrœmiacearum*, nov. gen. Seem." There is nothing answering to this in the American collection.

47. "*Calophyllum polyanthum*, Wall.?" = *C. spectabile*, Bot. Expl. Exped. Our specimen from the Mangsi Islands must be Miquel's *C. dasypodum*; and all are perhaps *C. lanceolatum*, Bl.

46. "*Calysaccion obovale*, Miq." To this apparently belongs the foliage which I had referred to *Garcinia Mangostana*.

50. "*Garcinia* (*echinocarpa?*)" is in the American collection too imperfect for determination.

53. "*Pittosporum Pickeringii?*" is that species, apparently, although it is in fruit, while the American collection has flowering specimens only, and with much longer peduncles.

54. "*P. Richii?*" (in fruit only) appears to be that species.

55. "*P. Brackenridgei*." This is not our plant, but answers to *P. Richii* in the flowering state.

56. "*P. tobiroides.*" Not our species of that name, but it is our *P. Brackenridgei.*

59. "*Aglaia? basiphylla.*" This is by no means that species, but it accords with an imperfect specimen (with young fruit only) mentioned in the Bot. Expl. Exped., p. 238. Perhaps it is a mere variety of Seemann's no. 60, *A. edulis.*

67. "*Cupania apetala*, Labill." The foliage resembles that of *C. leptobotrys*, Gray, but the inflorescence and fruit are different, and accord with Labillardiere's plate.

68. "*Cupania Vitiensis*, Seem." is doubtless a broad-leaved form of *C. falcata*, Gray, l. c., and of Seemann's no. 70.

73. I have not seen.

74 = 69. *Cupania rhoifolia*, Gray.

76. "*Vitis saponaria*, Seem." is the same as *Cissus geniculata* ? of our collection from the Feejees.

79. "*Smythea Pacifica*, Seem. gen. nov." To all appearance this is a *Ventilago*, with a particularly broad fruit. This is only partly grown in the specimen communicated,* which differs from my *V. Vitiensis* in the pubescent flowers crowded in sessile fascicles. M. Tulasne's *V. cernua*, from Rawak, excepting "stylo in basi pubente," well accords with *V. Vitiensis*, of which the fruit alone can determine whether Bentham's *V. leiocarpa* is really distinct, the difference in the inflorescence being unreliable.

81. "*Alphitonia zizyphoides*" is that species, which Remy collected in the Sandwich Islands also. My *A. franguloides* is evidently a mere variety of it.

82. "*Gouania Richii*" is probably that species; but the fruit in Seemann's specimen is less winged, and there are other slight differences.

83, 84. Destitute of flowers and fruit, and altogether dubious.

85. "*Rhamnea*" appears to be an undescribed *Colubrina.*

90. "*Melicope?*" is a form, with narrower leaflets, of what I had called *Euodia drupacea*, Labill.?

102. "*Zanthoxylon varians*, Benth." is perhaps my *Acronychia heterophylla*, without flowers or fruit.

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* Dr. Seemann's plate of this plant in a later number of the Bonplandia shows nothing inconsistent with this opinion, unless the figures 7 and 8 are intended to represent a fruit dehiscent in the manner of *Hippocratea.*

107. "*Tephrosia purpurea*, Pers." Also *T. piscatoria*, Pers.

113. "*Stronglodon ruber*, Vog." is interesting as making known the fruit of this plant, an oval and turgid legume, with two large seeds like those of *Canavalia*.

123. "*Rhynchosia minima*" is not that species, nor of the genus, having a pluriovulate ovary and I believe monadelphous stamens. It is probably a *Hedysarea*.

127. "*Pongamia piscatoria*, Seem." is *Derris uliginosa*, Benth.

133. "*Storckiella Vitiensis*, Seem. gen. nov." is entirely new to us, and not in the American collection.

156. "*Eugenia confertiflora*" is hardly the plant of the American Expedition, the leaves being larger and less pale beneath, the flowers apparently larger, the calyx-tube longer and striate-angled. But the materials for complete comparison are wanting.

162. "*E. rivularis*, Seem." does not well agree with any of ours; and the same may be said of 163, an unnamed *Eugenia*.

166. "*Nelitris fruticosa*," as to the specimen furnished, is *N. Vitiensis*.

168. "*Acicalyptus myrtoides*," completely as it accords in foliage with our plant of that name, is very different in the flower-buds, and somewhat so in the inflorescence. The characters of the two species may be expressed thus: —

A. myrtoides (Gray, Bot. Pacif. Exped., 1. p. 551, t. 67): alabastris elongato-oblongis acute quadrangulatis, operculo subulato; floribus deplanato-cymosis plerisque pedicellatis.

A. Seemanni (*A. myrtoides*, Seem. non Gray): alabastris clavatis inferne tantum tetragonis, operculo late conico breviter apiculato; floribus subthyrsoïdeo-cymosis plerisque sessilibus iis *A. myrtoidis* multo minoribus.

170, 171. "*Metrosideros*" seem to be only slender forms of 169, which is *M. collina*, Gray, but of the var. *glaberrima*.

172. "*Memecylon Vitiense*" is the var. β. of our collection.

173. "*Astronia Pickeringii*" is not that plant, but, as well as can be made out from the incomplete fruiting specimen, *Astronidium parviflorum*, Gray.

177. "*Medinilla*" accords with the specimen of *M. rhodochlæna*, Gray. Seemann's 175, so named, was not communicated, nor was 178.

181. "*Melastomacea*." This, with fruit only, accords with some undetermined foliage in the American collection.

182. "*Melastomacea*," seemingly a *Medinilla*, is none of ours.

184. "*Crossostylis biflora*, Forst." is by no means that plant, but a new species of our allied genus. It should bear the name of

Haplopetalon Seemanni: a *H. Richii* differt foliis majoribus obovatis subtus cum ramis novellis molliter pubescentibus; alabastris hirsutis; calycis segmentis petalisque sæpius 5; styli lobis 7.

196. "*Spiræanthemum Vitiense*" is not that species, but apparently a new one, much nearer *S. Samoense.*

198. "*Weinmannia*" is new to our collection, unless it be a variety of 197, *W. affinis*, of which 199 and 200 are obviously mere varieties.

206. "*Plerandra Pickeringii*" is hardly that species, but appears to be identical with 209, a new species of *Plerandra.* I have no specimen of 207.

208. "*Araliacea*" is also polyandrous, and is a remarkable new *Plerandra*, if its separate stigmas or short styles will allow.

213. "*Calycosia Milnei*, A. Gray," is the species described under that name in the Proceedings of the Academy, 4, p. 307, but with longer leaves. Drupe pyriform.

215. "*Dolicholobium longissimum*, Seem." may be a good species, but is not unlikely to be a variety of *D. latifolium*, Gray, with less ample leaves more downy underneath. The specimens of the two are not complete or full enough to settle this question.

216. "*Myrmecodia Vitiensis*, Seem.," is evidently *Hydnophytum longiflorum*, Gray, l. c., with shorter leaves.

217. "*Lindenia Vitiensis*, Seem." was not met with in the American Expedition.

218. "*Gardenia Vitiensis*, Seem." This is quite different from the only *Gardenia* from the Feejee Islands in our collection, that being a small-leaved form of *G. Taitensis.*

220. "*Canthium Harveyi*" is not at all the species published under that name, but apparently a form of 221, *C. lucidum*, Hook. and Arn.

223. "*Morinda*" is *M. myrtifolia*, Gray, l. c., with larger leaves; perhaps a mere variety of *M. umbellata.*

224. "*M. sp. fol. pubescentibus*," not communicated, is probably *M. mollis*, Gray, l. c.

226. "*M. phillyreoides*, Labill." was not communicated. There is nothing answering to that species in the American collection.

236. "*Stylocoryne corymbosa*, Labill." is *Psychotria Forsteriana β. Vitiensis*, Gray, l. c.

240. "*Randia?*" Not in the American collection. Perhaps a *Gynopachys* or *Griffithia.*

243. "*Psychotria calycosa*, A. Gray," is not that species, but *P. macrocalyx*, Gray, l. c.

246. "*P. Vitiensis*, Seem." is *P. calycosa*, Gray, but with the limb of the calyx less lobed.

247. "*P.? speciosa*, Forst." It may be that plant and *Cephælis fragrans*, Hook. and Arn., but the character fails to accord. Certainly it is no *Psychotria*, and is *Ixora* (*Phylleilema*) *Vitiensis*, Gray, l. c.

248. "*Psychotria.*" Foliage only, not identified.

249. = *P. platycocca*, Gray, the inflorescence undeveloped.

250. = *P. insularum*, Gray, probably; the materials scarcely sufficient.

251. = *P. Pickeringii*, Gray.

252. = *P. Pickeringii*, a narrow-leaved variety, or else an allied new species.

253. "*Psychotria*" is apparently a new species, very much like *P. filipes* (the fruit of which is unknown); but the calyx is truncate.

254. = 244 in flower, viz. "*P. collina*, Labill.," which it well may be.

255. "*P.* aff. *P. turbinatæ*, A. Gray," is new to me, and more like *P. Brackenridgei*, Gray, the flowers of which are unknown. The long corolla of the present species is quite unlike the other Oceanic species.

256. "*Rubiacea*, n. gen.?" is probably a *Canthium*, near *C. lucidum.*

257. "*Vangueria?*" Flower-buds too young for investigation. It resembles, but is not identical with, *Guettarda* (*Guettardella*) *Vitiensis*, Gray, ined., of which the fruit only is known.

258. "*Psychotriacearum*, gen. nov." Although the corolla is wanting, the plant may be confidently referred to *Ixora.*

259. "*Rubiacea*, gen. nov.?" Apparently a *Psychotria*, in flower only, near *P. Brackenridgei*, Gray, which is known only in fruit.

260. "*Rubiacea.*" New to me: — perhaps a *Griffithia.*

261. "*Erigeron Bonariensis*, Linn." In my view the original *E. Bonariense* of Linnæus, or Dillenius, is the *E. spiculosus*, Hook. & Arn., and *E. spinulosum*, DC. The present plant is *Erigeron albidum*, Gray, ined., the well known *Conyza albida*, Willd., *C. erigeroides*, DC., *C. floribunda*, H. B. K., &c.

268. "*Wollastonia strigulosa*, DC." This is rather *W. Forsteriana*, DC., which should include *W. insularis*, and has awnless achenia and

the involucre shorter and more imbricated (the scales ovate or oblong and obtuse) than *W. strigulosa*, DC. which (in part), along with *W. scabriuscula*, *glabrata*, and *canescens*, DC., I refer to *W. biflora*.

300. "*Geniostoma crassifolium*, Benth." is also *G. rupestre* var. *puberulum*, Gray, in Proceed. Amer. Acad. 4, p. 321, a form of 301.

304. "*Gærtnera*, sp." is a new *Geniostoma*, with small leaves.

303. "*Gærtnera pyramidalis*, Seem." is *Couthovia corynocarpa*, Gray.

305. "*G. barbata*, Seem." is a *Couthovia*, which, if truly distinct from the preceding, should be named *C. Seemanni*. The materials collected by Dr. Seemann, comprising flowers and fruit, confirm the genus *Couthovia*, and fix its position in the vicinity of *Strychnos*, calling, however, for some extension of the character of Bentham's third tribe. There are indications of dimorphism, or incipient difference in sex, in the flowers examined. Some corollas of *C. corynocarpa* are beardless, or nearly so, and have the anthers almost sessile in the throat, while others of the same cyme are conspicuously bearded in the throat, and their equally subexserted anthers are borne on filaments of their own length, inserted some way down on the tube. The style is sometimes slender and exserted, sometimes shorter or very short; the ovary in the latter is certainly fertile.*

306. "*Fagræa viridiflora*, Seem." This wholly accords with *F. gracilipes*, Gray, l. c., which was thought to have white or cream-colored corollas.

307. "*Fagræa Vitiensis*, Seem." is not in the collection of the American Expedition.

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* COUTHOVIA, Gray, Bot. Amer. Expl. Exped., ined., & Proceed. Amer. Acad. 4, p. 324.

Calyx quinquepartitus, segmentis imbricatis rotundatis crassis, marginibus tenuibus. Corolla brevis, quinquefida, æstivatione valvata. Stamina 5, tubo vel fauci inserta: filamenta brevia vel brevissima: antheræ oblongæ. Ovarium biloculare, ovatum, stylo apiculatum: stigma subcapitatum, bilobum. Ovula in placentis medio dissepimento adnatis plurima, amphitropa. Fructus clavatus, drupaceus, basi attenuatus, sarcocarpio tenui, putamine lignoso percrasso, 2-1-loculari, 2-1-sperma. Semina . . . . . Arbores Vitienses, glabri, stipulis *Labordeæ*, foliis subcoriaceis penninerviis obovatis, cyma terminali e radiis 2-4 apice multifloris, floribus parvis haud pedicellatis, corolla fere *Strychnarum* breviflorarum.

1. C. CORYNOCARPA: calycis segmentis ciliolatis; antheris oblongis utrinque emarginatis.

2. C. SEEMANNI: calycis segmentis margine glaberrimis; antheris subsagittatis; corolla fauce eximie albo-lanata, an semper? An forma præcedentis?

The remaining Monopetalæ will be annotated, when needful, in the following article.

2. *Characters of New or Obscure Species of Plants of Monopetalous Orders in the Collection of the United States South Pacific Exploring Expedition under Captain Charles Wilkes, U. S. N. With occasional Remarks, &c.*

By Asa Gray.

Characters of the new or more interesting *Compositæ*, *Lobeliaceæ*, and *Scævoleæ* of this collection were communicated to the Academy a year ago, and printed in the Proceedings, Vol. V. p. 115, *et seq.* The *Rubiaceæ* and *Loganiaceæ* were similarly discussed at earlier periods (Proceedings, Vol. IV., April, 1858, and September, 1859).

Calycereæ.

Boopis crassifolia (*Acicarpa crassifolia*, Miers in Ann. & Mag. Nat. Hist. 1860, p. 402): glaberrima; caule (spithamæo ad pedalem) ramoso adscendente; ramis ad apicem usque foliosis; foliis carnosis, caulinis sessilibus plerumque subamplexicaulibus lanceolatis seu lingulatis repando-denticulatis; capitulis breviter pedunculatis; involucro subcarnoso alte 5 – 7-fido, segmentis oblongis; filamentis vix basi monadelphis; acheniis fere pentapteris; calycis lobis maturis scarioso-cartilagineis dorso eximie carinatis intus concavis margine tenui eroso-denticulatis pl. m. difformibus, nunc late triangulari-ovatis acutis brevibus, nunc ovato-lanceolatis vel subulatis achenium dimidium adæquantibus; paleis receptaculi filiformibus apice spathulatis. — Rio Negro, North Patagonia, on the sandy shore. — I do not remember the state of Tweedie's specimen (from Maldonado) in the Hookerian herbarium, with which ours was long since compared. But probably it is not in fruit; else Mr. Miers would not have referred to *Acicarpha* a plant in which the calyx-lobes are certainly paleaceous and (although the narrower ones are rigid) not spinescent, and the achenia not at all concreted. He would more probably have found a place for it in his genus *Anomocarpus*, formed of some species of *Calycera.* Although I refer it to *Boopis*, notwithstanding some difformity in the calyx-lobes of different flowers, and the approach to a subulate character in the narrower ones, I am inclined to think that even *Boopis* is likely to be reduced to a mere section of the original genus *Calycera.*

Mr. Miers has adopted Brown's very qualified recommendation to change the orthography of Jussieu's *Acicarpha* to *Acicarpa*. But surely *carpha* may as well refer to calycine as to bracteal chaff, and the substituted name has no great advantage in etymological appropriateness.

Valerianaceæ.

VALERIANA PYCNANTHA (sp. nov.): herbacea, glaberrima, nana, multiceps e caudice crasso; foliis carnosis haud ciliatis, radicalibus lineari-spathulatis, caulinis 2 vel 3 verticillatis oblongis sessilibus versus medium scapi simplicissimi 1 – 4-pollicaris; floribus scarioso-bracteatis in capitulum demum oblongum arcte congestis; acheniis anguste ovato-oblongis lateribus enerviis; pappo 5 – 7-radiato, setis basi connatis. — Alpamarca, high Andes of Peru.

VALERIANA GLOBULARIS (sp. nov.): herbacea, depressa, cæspitosa, glabra; caudice crasso; foliis omnibus radicalibus subcarnosis anguste spathulatis vel sublinearibus basi attenuatis integerrimis; scapo nudo 1 – 3-pollicari capitulum globosum scarioso-bracteatum gerentibus; acheniis ovalibus lateribus enerviis; pappo 10 – 12-radiato, setis basi connatis. — Var. scapo brevissimo. — Casa Cancha, high Andes of Peru.

VALERIANA RHIZANTHA (sp. nov.): glabra; radice crassa fusiformi foliis rosulatis spathulato-rotundatis carnosis capitulum florum arcte sessile depressum circumdantibus coronata; pappo cupulato brevissime 5-radiato, radiis dentiformibus nudis per anthesin involutis. — Alpamarca, high Andes of Peru. "Succulent and said to be esculent; root fusiform," very large; "leaves an inch in length and breadth, obtuse, surrounding a central cake of flowers, all even at the surface and densely congested." Pickering, adn. Bracts scarious, not connate. Setæ of the pappus reduced to short, dentiform, naked processes on the border of a cup like that of many Valerians, within which they are inrolled in the usual manner. So that this species militates strongly against Persoon's genus *Phyllactis*, as recently restored and extended by Weddell.

Ericaceæ.

VACCINIUM MADERENSE, Link, and the allied *V. Arctostaphylos*, enumerated by Klotzsch (in Linnæa, 24, p. 65) among the "*non satis notæ*," having simply five-celled berries, awnless anthers, and at length campanulate corollas, belong to the section *Vitis-Idæa*, notwithstanding their deciduous leaves.

VACCINIUM CEREUM, Forst., of Tahiti, appears to me specifically distinct from the following, of the Sandwich Islands, which Chamisso and Schlechtendal, and afterwards Sir William Hooker, have combined with it. *V. cereum*, besides its more urceolate corolla, has shorter and bibracteolate peduncles, acute calyx-lobes, the anthers mucronulate at the base and their tubular horns not much surpassing the dorsal awns. The Sandwich Island *Vaccinia* have ebracteolate pedicels; and their very various and diverse forms appear to be reducible to two species, as follows: —

VACCINIUM RETICULATUM, Smith (*V. cereum*, Cham. & Schlecht. and Hook. Ic. Pl. t. 87), — the *Ohelo* of the Hawaians, — an extremely polymorphous species. Its anthers are wholly muticous at the base, the corolla cylindraceous when fully developed, and much exceeding the obtuse lobes of the calyx. A small-leaved and lucid form of it is *V. Macrœanum* of Klotzsch, which differs little from

Var. DENTATUM (*V. dentatum*, Smith), in which the corolla is sometimes shorter.

Var. CALYCINUM, the *V. calycinum*, Smith, described as having deciduous leaves, appears to be only a thinner-leaved form of *V. reticulatum*, growing in the shade of thick forest, and is connected with the ordinary state by various intermediate forms, among which is *V. Meyenianum*, Klotzsch. The dorsal awns of the anthers are sometimes very short or obsolete.

Var.? LANCEOLATUM, from the tabular summit of Kauai, is quite uncertain, the flowers being unknown; but it resembles the var. *dentatum*, except that the leaves are nearly lanceolate.

VACCINIUM PENDULIFLORUM, Gaud. is distinguished, not so much by its longer peduncles drooping in fruit and narrower acutish calyx-lobes, as by the shorter, nearly campanulate corolla, not much exceeding the calyx, and a strong cusp at the base of the anther. This last is represented in fig. 4 of Gaudichaud's plate, but is not referred to in the diagnosis, nor noticed by Dunal. Our collection (which has a form of *V. reticulatum* with equally long and pendulous peduncles) has of this species only the

Var. BERBERIFOLIUM: foliis obovatis seu obovato-oblongis eximie reticulatis margine dentibus spinuloso-setaceis crebris pulcherrime pectinatis; pedunculis folia vix excedentibus. — E. Maui, on Mouna Haleakala, and apparently on the mountains of Oahu. Anther bearing at its base a cusp or strong mucro, like that represented in Gaudichaud's figure of the anther of *V. penduliflorum.* Striking as are the very reticulated and spinulosely-serrate, Barberry-like leaves, these are not diagnostic of the species, since the teeth are not prolonged in the plant figured by Gaudichaud, and, on the other hand, this foliage is imitated in some specimens from Mouna Kea, which have roundish calyx-lobes and no basal cusp to the anthers, therefore belonging to the var. *dentatum* of the preceding species.

Nuttall's genus *Metagonia* is equivalent to Klotzsch's sections *Macropelma, Disterigma, Neurodesia,* and a part of *Vitis-Idæa,* including a variety of species, which, however distributed, cannot be properly separated from *Vaccinium.* The dorsal awns are not always erect in the section *Macropelma;* in our specimens of *V. cereum,* from Tahiti, they are sometimes (perhaps abnormally) reflexed.

Our collection has nothing answering to the *Epigynium? Vitiense,* Seem., no. 284 of his Feejee collection.

GAULTHERIA (DIPLYCOSIA) LUZONICA (sp. nov.): foliis ovalibus utrinque acuminatis supra glabris subtus ramisque novellis parce strigoso-hispidis; pedunculis fasciculatis petiolo longioribus; bracteolis connatis orbiculatis. — Luzon, in the Majaijai Mountains; in fruit.

Epacrideæ.

The pollen in all the following species of *Cyathodes* is four-lobed, in the manner of *Ericaceæ,* to a suborder of which the *Epacrideæ* should be reduced.

CYATHODES POMARÆ (sp. nov.): fruticosa, erecta; foliis subpatulis oblongo-linearibus mucronatis margine integerrimis (novellis prope apicem ciliolatis) subtus glaucis multinervibus, nervis extimis subramosis; sepalis bracteolisque rotundatis subciliolatis; corollæ tubo calycem bis superante, lobis imberbibus; stylo subulato ovario 5–7-loculari triplo longiore. — Society Islands, on the mountains of Tahiti. Dr. Pickering in his notes does not distinguish this from the plant gathered on Eimeo, which is not well to be discriminated from the following species; while this has larger flowers as well as leaves, the tube of the corolla exserted beyond the calyx, and a longer style. Mr. Brown long ago alluded to a Tahitian *Cyathodes* (Prodr. p. 539), but it seems to have been unnoticed from the time of Cook's voyages down to our own Expedition. The two brought by our collectors appear not to be uncommon; so it is remarkable that nothing of the kind was collected by Bertero or Mœrenhout; at least none is mentioned in Guillemin's

Zephyritis Taitensis. The common Hawaian species having been dedicated to a celebrated king of those islands, this may bear the name of the gentler Tahitian queen, *Pomare*.

The various forms from the Sandwich Islands, including one of the Society Islands, appear to be reducible to two species: —

CYATHODES TAMEIAMEIÆ (Cham.): fruticosa; foliis patulis oblongis cuneato-obovatis linearibusve sæpius abrupte mucronatis margine ad apicem ciliolatis subtus glaucis multinervibus, nervis sæpius ramosis, floralibus parvis; sepalis bracteolisque orbiculatis ciliolatis; corollæ tubo calycem haud excedente, lobis aut barbatis aut imberbibus; stylo crasso ovario 5 – 8-loculari æquilongo.

Var. α. CHAMISSOI (*C. Tameiameiæ*, Cham., Hook. & Arn., DC.): corollæ lobis intus pl. m. barbatis. — Oahu, &c.

Var. β. BROWNII (*C. Banksii* (Gaud.?) & *Macræana*, DC.): corollæ lobis imberbibus. — Maui, Kauai, and especially Hawaii.

Var. γ. SOCIETATIS: corollæ lobis intus parcissime barbatis; foliis plerisque linearibus. — Eimeo, and probably Tahiti. — This is most probably the Tahitian plant mentioned by Brown; while to our var. β may belong both the Sandwich Island species to which he alludes.

CYATHODES DOUGLASII (sp. nov.): fruticosa; foliis suberectis oblongis seu lanceolatis acuminato-cuspidatis margine plerumque hispidulo-ciliolatis subtus pallidioribus vel glaucis 5 – 9-nervibus, nervis sæpissime simplicissimis; sepalis bracteolisque ovatis obtusis ciliatis; corollæ tubo calycem æquante, lobis intus barbatis; stylo subulato ovario 6-loculari bis terve longiore. — Hawaii, on Mouna Loa and Mouna Kea; also Maui, on Mouna Haleakala.

Var. β. STRUTHIOLOIDES: foliis erectis lanceolatis seu ovato-oblongis; sepalis acutis! Mouna Kea, high in the pastoral region; and perhaps a form on the mountains of Kauai, without flowers or fruit.

None of the various specimens here combined accord with the *C. Banksii* so imperfectly characterized by De Candolle. For, although the leaves are more or less erect, and rarely glaucous-white beneath, they are rough and ciliolate or serrulate on the margins, and with a pungent point; their nerves usually all simple. Also the larger flowers and longer style should distinguish all forms of this from the preceding species, unless that is even more polymorphous than I have supposed. As to the style in this and allied species, I should rely more upon it if I did not entertain some suspicion of diœcio-dimorphism in the genus.

The *Leucopogon* of the Feejee Islands, which Dr. Seemann has referred to *L. Cymbulæ*, Labill., of New Caledonia (in Bonplandia, 1861, p. 257, no. 285), I had characterized as *L. Vitiensis*.

Styracaceæ, incl. *Symplocineæ*.

There is no *Styrax* in the collection of the American Expedition. One would be much disposed to adopt the division, not, with Miers, into three genera, but into two, viz.: 1. *Styrax*, and 2. *Strigilia*, Cav., including *Cyrta*, Lour. Between the latter I can perceive no essential distinction. Bentham, however, appears to be justified in his conclusion, "that *Styrax* as a whole is far too natural to be thus broken up into distinct genera. The degree of adherence of the ovary and of the persistence of its dissepiments is variable in species otherwise closely allied," — and the same remark applies to the æstivation and texture of the corolla. It is remarkable that Miers should have referred that most true *Styrax*, *S. Japonica*, to his genus *Cyrta*, and have excluded from the latter *S. Benzoin*.

Symplocos spicata, Roxb. To this Indian, South Chinese, and Archipelagic species Dr. Seemann refers one which he, as well as our naturalists, collected plentifully in the Feejee Islands, — probably with good reason, although our specimens have for the most part the leaves entire or nearly so, and a shorter inflorescence. It runs into several varieties, one with very large leaves.

Ebenaceæ.

Diospyros Samöensis (sp. nov.): ramis novellis vix puberulis; foliis glabris ovato-oblongis obtuse acuminatis basi acutis laxe venosis (3 – 6-poll.); pedunculis masculis 3 – 9-floris, fœmineis solitariis unifloris petiolum subæquantibus; calyce 4-fido sericeo-puberulo, lobis obtusissimis, fœmineis rotundatis basi intus quasi coronatis corollam extus sericeam 4-fidum adæquantibus; staminibus 8 – 9; ovario hirsuto 8-loculari; fructu globoso. — Tutuila and Savaii, Samoan or Navigators' Islands; "in woods, and also sometimes planted."

Maba foliosa (Rich, in herb.): foliis confertis lato-ellipticis utrinque rotundatis basi cordatis brevissime petiolatis glabratis (pollicaribus vel sesquipollicaribus), novellis cum ramulis fructibusque olivæformibus ferrugineo-tomentulosis; pedunculis fructiferis brevibus 1 – 3-floris; calyce trilobo. — Muthuata and Ovolau, alt. 2,000 feet, Feejee Islands.

Maba elliptica, Forst., which apparently includes *M. major*, Forst., and which varies considerably in the shape of the leaves (in one form lanceolate-oblong and more or less acuminate), was gathered at the Tonga or Friendly, and the Samoan or Navigators' Islands, with the nascent leaves and shoots fulvous-hirsute, as described; while the Feejean collection has apparently the same species with the young parts glabrous. To this last may probably be referred all three *Mabæ* of Dr. Seemann's collection.

MABA SANDWICENSIS (A. DC.): foliis lato-lanceolatis oblongis seu ovalibus coriaceis pallidis venuloso-reticulatis glabratis, novellis cum ramulis floribusque sericeo-pilosis; floribus in axillis subsessilibus, masculis 15–17-andris calyce alte trifido, fœmineis ——; fructu ovali calyce breviter trilobo stipato. — Ludit foliis nunc utrinque acutiusculis vel obtusiusculis, nunc basi rotundatis, nunc utrinque rotundatis basi retusis, sesquipoll. ad 4-poll. — Oahu, Hawaii.

Sapotaceæ.

SERSALISIA GLABRA (sp. nov.): foliis obovato-oblongis basi attenuatis coriaceis glabris, venis reticulatis; pedicellis in axillis fasciculatis petiolo duplo longioribus; corolla calyce subsericeo paullo longiori campanulata 5-fida glabra, lobis rotundatis filamenta sterilia subulata multo superantibus stylo gracili æquilongis.—Woolongong, New South Wales. There is a specimen of this in the Hookerian herbarium from Mr. Backhouse; also a related one from Fraser, which is perhaps the *S. laurifolia* of Richard, and one from Cunningham, named *Mimusops myrsinoides*, may be the same thing.

ISONANDRA? RICHII (sp. nov.): undique glabra; foliis chartaceis obovatis apice rotundatis nunc retusis basi acutis; pedicellis calyce 4-fido plusduplo longioribus; filamentis barbatis. *Bassia retusa*, Rich, in herb. — Tongatabu. Only a single and not very perfect corolla is extant from which to determine the genus. As that appears to be four-cleft, like the calyx, and with a fertile stamen in the sinuses, as well as one before each lobe, and there are no appendages, I refer the plant to *Isonandra*, notwithstanding the bearded filaments.

BASSIA AMICORUM (sp. nov.): foliis obovatis seu ovalibus retusis glabris viridibus (3–6-poll.); pedicellis elongatis; corolla glabra 6-partita (semipollicari) calyce 6-nervi plusduplo longiore; staminibus 18; filamentis subulato-filiformibus antheris lineari-sagittatis cuspidatis æquilongis. — Tongatabu, on the shore. Mr. Rich supposed this to be Forster's *B. obovata*, from Tanna; but that has the leaves less veiny, more tapering at the base, and somewhat pointed at the apex, shorter pedicels, much smaller flowers, and the corolla (probably more than six-cleft) pubescent externally.

SAPOTA? PYRULIFERA (sp. nov.): glabra; foliis oblongo-lanceolatis utrinque subacuminatis pallidis subcoriaceis tenuiter transversim venosis (3 – 5-poll. longis); calyce 5-partito; fructu pyriformi parvo (semipollicari) pedunculo paullo longiori semine unico obovato turgido repleto. — Ovolau, Feejee Islands. Flowers unknown.

SAPOTA? VITIENSIS (sp. nov.): glabra; foliis oblongis seu obovato-oblongis obtusis vel retusis subcoriaceis reticulatis (4 – 6-poll. longis) basi in petiolum longiusculum attenuatis; fructu subsessili globoso 3 – 4-sperma (pollicem diametro). — Ovolau, Feejee Islands, on the coast.

A third Feejean species was gathered on Vanna-levu, the materials wholly insufficient for determination.

SAPOTA SANDWICENSIS (sp. nov.): foliis elliptico-oblongis basi acutis tenuiter transversim venosis et reticulatis mox glabris, novellis ramulisque pube tenui rufa seu albida tomentulosis, petiolo gracili pedicellis longiore; floribus pentameris; corolla glabra calycem vix superante, lobis ovatis acutiusculis; staminibus sterilibus spathulato-lanceolatis cum 5 fertilibus subinclusis; ovario 5-loculari. — Var. *α.* foliis obtusissimis 3 – 6-pollicaribus, petiolo sæpe sesquipollicari. *β.* foliis 1½ – 3-pollicaribus sæpe acutiusculis. — Sandwich Islands: mountains of Oahu, where it was also collected by Remy (no. 478) in fruit. *β.* Hawaii and Lanai, Remy (no. 475, 476). A genuine *Sapota*, of De Candolle's second section. Fruit like a small apple. Seeds albuminous. Ovules ascending.*

Primulaceæ.

LYSIMACHIA HILLEBRANDI, Hook. f. (sp. nov.): fruticosa, glabrata, ramosa; ramis undique foliosis; foliis alternis nunc verticillatis ellipticis oblongis lanceolatisve sæpius acutatis vel acuminatis subcoriaceis laxe reticulato-venosis; pedunculis ex axillis superioribus nutantibus unifloris ferrugineo-pubescentibus; floribus 5 – 8-meris; corollæ subrotatæ lobis late obovatis sepala ovato-lanceolata acuminata fere duplo excedentibus; filamentis basi monadelphis styloque gracilibus. — Sandwich Islands.

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* The doubtful plant from Kauai mentioned in Dr. Pickering's printed Notes (p. 403), in connection with the above "Chrysophylloid" tree, proves to be a *Xylosma* (in fruit only), and one which was likewise gathered by Remy (no. 536) in Hawaii, but with less rigid and coriaceous leaves. I think it is not distinct from *X. orbiculatum*, Forst., which, along with *X. Lepinei*, and perhaps *X. goniocarpum* and *X. integrifolium*, of Clos's monograph, may be safely combined with *X. suaveolens*, Forst. The leaves of the original species are similarly reticulated, but the finer meshes are not sufficiently exhibited in Plate 4 of the Botany of the Exploring Expedition.

Var. *a.* foliis ellipticis seu elliptico-lanceolatis basi in petiolum angustatis. *L. Hillebrandi*, Hook. f. in litt. — Oahu and Maui.

Var. *β.* DAPHNOIDES: foliis oblongis arcte sessilibus et crebris. — Kauai.

Var. *γ.* ANGUSTIFOLIA: foliis lineari-lanceolatis creberrimis. — Maui, coll. Remy.

A truly shrubby *Primulacea*, attaining several feet in height, but a genuine *Lysimachia*.

There are specimens in our collection from the Sandwich Islands, and much better ones in Remy's, apparently referable to *Lysimachia lineariloba*, Hook. & Arn., from the Loo Choo Islands. At least, no notable difference appears between them and fine specimens gathered by Mr. Wright, both in the Loo Choo Islands and in Japan, — the more luxuriant forms of which accord with *L. lubinioides*, Sieb. & Zucc. But Zuccarini's *L. lineariloba* from Bonin must be different, being said to have lanceolate acute sepals, and pedicels scarcely two lines long. His description of *L. lubinioides* applies to our plant, except that the style is not short, nor are the filaments, even in his own plant, monadelphous at the base. The divisions of the corolla are spatulate, not linear, so that the specific name is deceptive, the stem is herbaceous, and the thickish leaves by no means "*impunctate*."

Myrsinaceæ.

MÆSA PICKERINGII (sp. nov.): foliis lato-lanceolatis oblongisve subintegerrimis mox glabris, nascentibus ramulisque pilosulis; racemis axillaribus simplicibus rariusve compositis gracilibus; calyce cum bracteis ovato-subulatis hirsuto, lobis ovatis acutis corollæ tubum subæquantibus; drupis ovoideis. — Viti-levu, one of the Feejee Islands. — Differs from *M. nemoralis* (which we have from the Samoan and Friendly Islands) in the hairy pubescence of the inflorescence, especially of the calyx, narrower leaves, smaller flowers, and narrower and acute bracts and bractlets. The latter is completely glabrous, with the bracts, bractlets, and calyx-lobes (especially the latter) broadly ovate and obtuse. To *M. nemoralis* probably belongs a portion of no. 286 of Dr. Seemann's collection. The remainder, with ferrugineous-puberulent inflorescence, is something different, but hardly *M. Indica.*

MÆSA PERSICÆFOLIA (sp. nov.): glabra; foliis lato-lanceolatis integerrimis, venis transversis; paniculis axillaribus folio sub-brevioribus; floribus parvis; bracteis bracteolis calycisque lobis ovato-acutis; corollæ tubo campanulato calyce paullo longiori; drupis ovoideo-globosis brevissime pedicellatis. — Mbua or Sandalwood Bay, &c., Feejee Islands. No. 287 of Dr. Seemann's collection, in his list referred to "*M. Indica*, var." is perhaps a form of this species; but the pedicels are longer, the leaves broader, of thicker texture, and the primary veins much more ascending.

MÆSA CORYLIFOLIA (sp. nov.): foliis ovatis cordatis repando-dentatis cum ramis paniculisque (terminalibus et axillaribus folium adæquantibus) dense mollissime pubescentibus superne mox glabratis; pedicellis flore haud longioribus; bracteis bracteolisque ovato-subulatis parvis; calycis lobis triangulari-ovatis villosis tubum corollæ brevi-campanulatæ fere æquantibus; drupis ovoideis puberis. — Mountains of Muthuata, Feejee Islands. "*M. macrophylla*, Wall.?" no. 288 of Seemann's list, is this species in fruit. The specimens of our Expedition are in flower only.

MYRSINE MYRICÆFOLIA (sp. nov.): glaberrima; foliis subspathulatis seu oblongis basi cuneatis in petiolum attenuatis integerrimis apice sæpius retusis utrinque crebre punctulatis, venis vix perspicuis; floribus tetrameris sessilibus; calycis lobis lato-ovatis obtusissimis; corolla quadripartita; drupis globosis. Muthuata, Feejee Islands. Eimeo, Society Islands. Drupe closely sessile or nearly so, — by which this species may be distinguished from any form of *M. capitellata* (including *neriifolia*, *Korthalsii*, &c.); but the discrimination of some forms of this from *M. crassifolia* may be more difficult. The fruiting specimens of Seemann's no. 289 are ambiguous between these two; the female flowering ones, and also no. 290 (foliage only) belong to *M. myricæfolia.*

MYRSINE? BRACKENRIDGEI (sp. nov.): glabra; foliis membranaceis oblongis utrinque acutis vel acuminatis petiolatis margine integerrimis vel undulatis; pedicellis filiformibus fructu globoso 3–5-plo longioribus; calyce 5-lobo, lobis rotundis ciliatis. — Mountains of Ovolau, Feejee Islands. In fruit only; probably of this genus.

MYRSINE TAITENSIS (sp. nov.): glaberrima; foliis crasso-coriaceis oblongo-ellipticis seu ovalibus integerrimis utrinque obtusis brevissime petiolatis supra nitidis crebre costato-venosis, venis venulisque reticulatis prominulis; pedicellis fructu longioribus; calycis fructiferi lobis 4 triangulari-ovatis acutiusculis. — Mountains of Tahiti, Society Islands. Flowers not seen.

From the Sandwich Islands I have seen nothing answering to *Myrsine Gaudichaudii*, A. DC., with subsessile fruits and triangular acute calyx-lobes, but the collection comprises various forms of *M. Sandwicensis* and *M. Lessertiana*, the latter mostly with obovate- or cuneate-oblong and obtuse, or even retuse, leaves, the largest 5 or 6 inches in length. Their scanty flowers enable me to ascertain that the petals are distinct to the base and valvate in æstivation. De Candolle's tribe *Emblieæ* manifestly should be suppressed, and his two suborders certainly do not merit such a rank.

ARDISIA? CAPITATA (sp. nov.): arborea? glabra; foliis ad apicem ramorum crassorum congestis obovato-spathulatis ultrapedalibus subcoriaceis integerrimis reticulato-venulosis basi in petiolum brevem crassum angustatis; pedunculis axillaribus compressis simplicissimis capitulum strobilaceum gerentibus; bracteis magnis squamaceis persistentibus. — Ovalau, Feejee Islands. — *A. grandis*, Seemann, no. 293 (in fruit only), considerably resembles this in foliage, but has thyrsoid panicles.

Oleaceæ.

OLEA SANDWICENSIS (sp. nov.): lævis; foliis lato-lanceolatis oblongisve acuminatis integerrimis petiolatis supra lucidis subtus pallidis; racemis axillaribus brevibus; corolla profunde quadripartita; staminibus (an semper?) 4; ovario conico; drupa ovoidea (in stirp. angustifol. oblonga). — Oahu, Sandwich Islands; also in Remy's collection from Kauai (no. 479), and a narrow-leaved form, with the immature fruit similar to a common olive, from Molokai (no. 482). Leaves resembling those of *Laurus nobilis*. The four stamens, although unusual in the family, are not unprecedented, being occasionally met with in *Chionanthus*.

Blume, followed by Endlicher and De Candolle, attributes to *Chionanthus* and *Linociera* an exalbuminous seed and a thick embryo; and De Candolle founds a tribe thereupon. But this is not the case in the original species, — *C. Virginica*, as I had long ago noted, and *C. (Linociera) ligustrina*, as Charles Wright had observed upon the living plant in Cuba, and I have verified in the dried specimens, having the albumen and flat cotyledons of *Olea*. I have no ripe fruit of the Asiatic species, but Dr. Hooker informs me that they are truly exalbuminous in *C. montana, purpurea, &c.*, and also in the West Indian *C. compacta;* — from which it would appear that this character is here not even of generic importance.

C. Virginica is occasionally three-seeded.

Jasminaceæ.

JASMINUM TETRAQUETRUM (sp. nov.): erectum, glabrum; foliis oppositis unifoliolatis, articulo petioli obscuro, foliolo ovato-lanceolato seu ovato acuminato basi acutiuscula trinervi; pedunculis brevibus paucifloris; calyce fructifero tetraptero, alis angustis deorsum in pedicellum longe clavatum decurrentibus sursum in dentes lineari-subulatos verticales tubum 2 – 3-plo superantes productis. — Feejee Islands, on the mountain summit back of Muthuata. In fruit.

J. simplicifolium, Forst. (*J. australe*, Pers., and by some clerical mistake "*J. gracile*, Forst.," in Dr. Seemann's list) was collected on the Feejee and other islands; and *J. didymum*, Forst. (= *J. divaricatum*, R. Br. and *J. parviflorum*, Decaisne) on the Tonga and Samoan, as well as the Society Islands.

Apocynaceæ.

ALYXIA BRACTEOLOSA (Rich, in herb. Ex. Exped.): subscandens, glaberrima; foliis plerumque ternis oblongis vel sublanceolatis nunc obtusis nunc acumine obtuso apiculatis caudatisve basi acutis vel rotundatis supra nitidis transversim lineatis sublonge petiolatis; cymis axillaribus plurifloris brevissime pedunculatis petiolum vix superantibus; pedicellis brevibus arcte imbricato-bracteolatis; bracteolis ovato-triangularibus dorso carinatis intus concavis ciliolatis sepalis consimilibus; corolla lutea longius tubulosa; stigmate imberbi; ovariis glaberrimis, drupis subglobosis breviter stipitatis. — Navigators', Tonga, and Feejee Islands.

Var. *β*. **MACROCARPA**: fructu olivæformi maximo (sesquipollicari) e drupellis 2 – 3 conflatis. *A. macrocarpa*, Rich, in herb. Feejee Islands.

Var. *γ*. **ANGUSTIFOLIA**: alte scandens; foliis minoribus angustioribus etiam sublinearibus. *A. stellata*, Seem. in Bonpl. 1861, p. 257, no. 310. Tonga and Feejee Islands.

Var. γ. PARVIFOLIA: foliis minoribus ellipticis (1½ – 2-poll.); pedunculis paucifloris nunc elongatis, fructiferis petiolo bis longioribus. Feejee Islands.

The other species of the collection are *A. stellata*, from the same groups of islands, and from Tahiti and Eimeo; *A. scandens*, only from the latter; and the Sandwichian *A. olivæformis*, Gaud., to which must be referred *A. sulcata*, Hook. & Arn., and may be referred a small-leaved variety, *myrtillifolia*.

CERBERA ODOLLAM, Gærtn., from Tahiti, &c. (where it is not indigenous), must be Forster's and Guillemin's *C. Manghas*.

CERBERA LACTARIA, Hamilton (*C. Odollam* of Dr. Seemann's collection) comes from Tongatabu and the Feejee Islands. So also does

OCHROSIA PARVIFLORA, Hensl. (*Cerbera*, Forst.): it is named *O. elliptica* by Seemann, and perhaps it is Labillardiere's plant. To the lamented Prof. Henslow's account may be added, that the ovaries are not really united except at their apices, that the ovules are eight, four on each margin of the suture, amphitropous, the micropyle superior.

OCHROSIA SANDWICENSIS, A. DC. is not in the collection of the Expedition, but is in Remy's collection; the flower-buds almost an inch long, the narrow lobes of the corolla rather longer than the tube, which is glabrous within. Ovules 3 or 4 in each ovary. Seeds peltate on each face of the nearly complete false partition, exalbuminous? Radicle inferior!

LYONSIA LÆVIS (sp. nov.): glabra; foliis ovatis subcordatis acutato-acuminatis; calycis lobis triangularibus acutis brevibus; corolla fere glabra fauce tantum annulatim barbata; squamis nectarii discretis glaberrimis ovarium subæquantibus; capsula cylindrica leviter bisulcata. — Feejee Islands. This is probably the *Echites scabra?* of Dr. Seemann's collection, no. 315, of which I have seen no specimen; but it differs from the New Caledonian plant (judging from Labillardiere's figure) in the pointed leaves, the general smoothness, smaller and acute calyx-lobes, glabrous nectary and ovary, terete capsule, and nearly glabrous corolla, within having a bearded ring instead of five vertical bearded lines. Of his *Lyonsia*, Brown well remarked that it is *Parsonsiæ nimis affinis*. The best distinction is to be found in the thickish lobes of the corolla, essentially or nearly valvate in æstivation; so that here, rather than in *Parsonsia*, belongs *P. ventricosa* of F. Müller.

Alstonia, R. Br., subgen. **Dissuraspermum**. Semina undique æqualiter et creberrime ciliato-plumosa, haud vero comosa, basi apiceque in acumen vel caudam producta, cauda superiori apice bifida: albumen tenuissimum. Corollæ lobi lineari-lanceolati, æstivatione sinistrorsum (sensu Candollii) convoluti: faux barbata.— Frutices vel arbusculæ insularum, foliis oppositis, petiolis angustissime marginatis basi pl. m. dilatatis, cymis patentibus.

A. (Dissuraspermum) costata, R. Br. (*Echites*, Forst.) Society Islands. Brown's doubt whether the cilia which fringe the seeds were elongated at the base and apex into a coma, evinced his usual caution. In fact, the seeds are not properly comose at all, but equably ciliate-fringed all round, the tails short, flat, and equally fringed with the rest of the margin, the lower one entire and rather blunt, the upper notched or bifid. The rudiments of one or both of these tails are to be seen in *A. ophioxyloides*, F. Müll., in which the hairs extend both ways into a coma. Forster's description of the seeds "*margine cylindrica*" is, I presume, a lapsus for "*margine ciliata*."

A. (Dissuraspermum) plumosa, Labill., to which must belong our specimens from the Samoan and Feejee Islands, is more closely related to the foregoing than would be inferred from Labillardiere's plate, as that does not well represent the stigma (indusiate-appendaged below, and with sharper lobes above), nor the calyx, which is five-parted to the base. But the seeds are not badly figured, except that the long tails are flat in our specimens, rather than exactly filiform. These two species might be wholly detached from *Alstonia* with better reason than *Blaberopus* has been.

Asclepiadaceæ.

Tylophora Samöensis (sp. nov.): herbacea, volubilis, fere glabra; foliis cordatis acuminatis membranaceis; pedunculis filiformibus petiolo apice glandulifero longioribus; umbellis plurifloris; corollis virescentibus; coronæ stamineæ foliolis subcarnosis lineari-oblongis apice acutiusculo antheras adæquante tantum a gynostegio liberis; polliniis obovato-oblongis adscendentibus brevissime stipitatis.— Savaii, one of the Samoan Islands. Follicles 6 inches long, slender, smooth.

Tylophola Brackenridgei (sp. nov.): volubilis, glabrum; foliis ovatis subcordatis mucronatis; pedunculis petiolum apice haud glanduliferum subæquantibus; umbellulis plurifloris; floribus carneis undique glabris; corona staminea e glandulis seu gibberibus carnosis lateraliter compressis usque ad apicem acutum adnatis (in sicco subulatis) anthera brevioribus; polliniis ovalibus juxta medium stipiti brevi flexuoso affixis adscendentibus. — Ovolau, Feejee Islands. Stigma depressed. Immature follicles smooth, short, acuminate-rostrate. Probably this is a congener of Endlicher's *Hybanthera biglandulosa*, the pollen-masses of which are probably not so pendulous as is represented. The structure of the andrœcium is very similar, but the coronal appendages are transversely dilated at the base, thence gradually tapering to an acute summit, the whole perfectly adnate to the back of the anther. In Dr. Wight's *Iphisia* (*T. Iphisia* and *T. Govanii*, Decaisne) I find the same structure, the fleshy appendages equally adnate and laterally compressed.

GYMNEMA SUBUNDUM (sp. nov.): volubile, undique glabellum; foliis membranaceis ovato-lanceolatis seu ovato-oblongis basi rotundatis vel subcordatis; pedunculis petiolum adæquantibus; umbella sæpius bifida; corolla rotata 5-partita imberbi squamulis fere obsoletis sinubus instructa; gynostegio brevissimo. — Mountains of Muthuata, Feejee Islands. — To *Gymnema* both *Gongronema* and *Bidaria* must doubtless be restored. The æstivation of the corolla, said by Blume to be valvate, is convolute, as described by Decaisne, in all the species I have examined, but in most of them the margins so slightly overlap that the æstivation might readily be taken for valvate.

GYMNEMA STENOPHYLLUM (sp. nov.): fruticosum, erectum (3–6-ped.), ramosissimum, fere glabrum; foliis coriaceis linearibus basi attenuatis marginibus revolutis, costa subtus pilosula; pedunculis axillaribus brevissimis; corolla rotata alte 5-fida inappendiculata, lobis extus glabris intus tenuiter barbatis; gynostegio brevissimo; polliniarum stipitibus gracilibus spiraliter contortis. — Feejee Islands, on the barren upland of Muthuata. This has recently been collected by Dr. Seemann (no. 322), who has obtained it with young follicles. These are slender, almost as much so as the leaves, and smooth. The pollinia accord with the character of *Sarcolobus*, R. Br., but they are not "apice lateraliter pellucidæ," as Miquel has it. Dr. Seemann takes this for a new genus, and indeed, as the genera are arranged by Decaisne, it does not accord throughout with either *Bidaria*, *Gongronema*, or *Gymnema* proper, while the erect habit is also peculiar. But if the two former genera be restored to *Gymnema*, the present plant could not well be excluded.

HOYA BICARINATA (sp. nov.): scandens; foliis glabellis subcarnosis planis obscure penninerviis ovalibus seu ovatis brevissime abrupteque acuminatis basi rotundatis subcordatisve, lamina supra petiolum hirtellum glandulosa; pedunculo pedicellis haud longiori; sepalis lineari-oblongis; corollæ albæ extus glabræ intus puberulæ lobis ovatis acutis planis; coronæ stamineæ foliolis incrassatis, disco obovato concavo angulo interno longiuscule acuminato, marginibus haud revolutis, dorso eximie bicarinato. — Samoan, Tonga, and Feejee Islands. This may be Forster's *Asclepias volubilis* (non Linn.), from Tanna. It is the *Hoya Billardieri*, no. 319, of Dr. Seemann's list; but hardly that of Decaisne. For the pieces of the stamineal crown are strikingly acuminate, instead of "angulo interiore obtuso."

HOYA DIPTERA, Seemann, no. 320, we have also from the Feejee Islands, along with other indeterminable specimens equally without flowers or fruit.

Convolvulaceæ.

JACQUEMONTIA SANDWICENSIS (*Convolvulus ovalifolius*, Hook. & Arn., non Vahl. *Ipomæa ovalifolia*, Chois. pro parte): villoso-pubescens, nunc glabrata; caulibus e radice tuberosa procumbentibus; foliis carnosulis obovatis cuneato-oblongisve emarginatis vel obcordatis breviter petiolatis; pedunculis folium æquantibus 1–3-floris; sepalis 3 exterioribus ovatis obtusis herbaceis, 2 interioribus multo minoribus oblongo-lanceolatis acuminatis; corolla calyce duplo longiore. — Sandwich Islands; common. Root, according to Dr. Pickering, tuberous and edible. Stigmas elongated-oblong, flattish.

BONAMIA MENZIESII (sp. nov.): caule lignoso decumbente; ramis volubilibus, junioribus herbaceis cum foliis ellipticis utrinque obtusis vel retusis (supra mox glabratis) aurato-tomentulosis; pedunculis axillaribus unifloris recurvis, fructiferis deflexis; sepalis rotundatis coriaceis sericeis; stylis 2 basi connatis; capsula ovoidea coriacea evalvi; seminibus baccatis. — Sandwich Islands, where it was discovered by Menzies.

Var. β. foliis oblongis seu ovato-lanceolatis acutis vel acuminulatis. *Convolvulus ovalifolius*, var.? Hook. & Arn. — Maui, Remy, no. 420.

We have abundant ripe fruit and a few flower-buds. Remy's no. 420 had dropped the corollas, but exhibited the styles. Corolla silky externally. Ovary 2-celled, each cell biovulate. Stigmas capitate. Seeds 4 or only 2, with a baccate-fleshy purple or crimson episperm, covering a hard seed-coat. If Brown has rightly stated the difference between *Bonamia* of Thouars and his *Breweria*, the two genera cannot be maintained, and the older genus of Thouars must also include *Stylisma*, Raf. Traces of the fleshy episperm are perceptible in *B. Roxburghii* and in our *B.* (*Stylisma*) *humistrata*.

Hydrophyllaceæ.

The study of a *Nama* from the Sandwich Islands led to the examination of all the species known to me, with the following result: —

NAMA, *Linn.*

§ 1. Folia in caulem alato-decurrentia, obovata vel spathulata, pube molli villosa seu pilosa: rami procumbentes.

1. N. JAMAICENSIS, Linn.: pube brevi; foliis late obovatis spathulatis; pedunculis brevissimis vel calyce brevioribus; capsula oblonga demum patente vel reflexa. — Key West, *Blodgett.* Mexico and Texas, *Berlandier* coll. no. 2049, 2062, 2298; Drummond, coll. 2, 316; *Lindheimer*, no. 476, 642 (the latter with very large leaves); *Wright*, *Gregg*, *Ervendberg*, no. 189.

2. N. BIFLORA, Chois.: villosa; foliis spathulato-oblongis; pedunculis plerisque in pedicellos filiformes (fructif. semipollicares et ultra) bifurcatis; capsula brevi. — Mexico, between Victoria and Tula, *Berlandier*, no. 2200, not 220 as recorded in DC. Prodr.

§ 2. Folia in caulem haud decurrentia, sæpius cinerea, nec incanæ:

* Omnia in petiolum sat manifestum attenuata: radix dura, "lignosa," perennis?

3. N. ORIGANIFOLIA, H. B. K.: molliter cinereo-pubescens, cæspitoso-diffusa; foliis parvis (adjecto petiolo 3 – 6 lin. longis) obovatis seu spathulato-oblongis, venis subtus prominulis; floribus sæpius geminis; pedunculis calyce brevioribus; capsula ovali-oblonga. — *N. origanifolia* & *N. rupicola*, Chois. Hydrol. & in DC. l. c. *N. subincana*, Willd. in Rœm. & Schult. l. c. — *N. dichotoma*, var. *parvifolia*, Torr. Bot. Mex. Bound. p. 147. — This occurs in Berlandier's collection as no. 2254, collected "between Santander and Victoria," Mexico, upon which specimens I suppose that Choisy's *N. rupicola* is partly founded. The *N. origanifolia* figured and described by Kunth is, I presume, of the same species. But the plant, as I suspect from the inspection of Berlandier's specimens, is not truly fruticulose, but is

rather an annual, with the base indurated, as is common in these dry regions late in the season. Dr. Torrey's fine specimens, from Santa Rosa, Chihuahua, Dr. Bigelow, and Monterey, Edwards and Eaton, accord with Berlandier's.

** Folia sessilia vel basi attenuata vix petiolata (radix annua):

+ Pube molli sæpius pl. m. viscosa cinerea vel hirsutula: sepala (modo generis) sursum dilatata.

4. N. UNDULATA, H. B. K. Pube molli et hirsutula cinerea; foliis margine sæpe undulatis, superioribus oblongis basi lata arcte sessilibus, inferioribus oblanceolatis deorsum longe attenuatis; floribus breviter pedunculatis vel subsessilibus plerisque lateralibus; capsula elongato- seu lineari-oblonga. Var. β. (*Macrantha*, Chois. Hydrol. t. 2, f. 1): foliis caulinis basi vix attenuatis; pedunculis nunc brevibus nunc gracilioribus calyce æquilongis. — Mexico and S. Texas. To this I refer Berlandier's no. 2116 (the var. β.), 1095, 1435, 2111, 2120, 2195, 2215, 2328, 2525, and some specimens collected by Dr. Gregg. A fragment from California, collected by Mr. Wallace, seems also to be of this species. So is a plant collected at Fort Yuma by Major Thomas, in herb. Torr.

5. NAMA DICHOTOMA (Chois.): viscoso-pubescens; foliis spathulato-oblongis oblanceolatisve basi attenuatis subsessilibus; floribus plerisque in dichotomiis sessilibus vel pedunculis calyce dimidio brevioribus; capsula ovato- seu breviuscule oblonga. *Hydrolea dichotoma*, Ruiz & Pav. Fl. Per. 3. p. 22, t. 244. — Taking Spruce's no. 5802, from the Equatorian Andes, to represent Ruiz and Pavon's plant, with the alar flowers sessile and the corolla not exceeding the calyx, I refer to it Coulter's no. 916 from Mexico, and his no. 463 from California; in both of which the flowers in the forks are sometimes nearly sessile, and sometimes short-peduncled, or short-peduncled lateral flowers come from the reduction of one fork to a short peduncle; and the corollas are twice as long as the calyx. But all the species appear to vary in this respect.

6. N. SANDWICENSIS (sp. nov.): pube brevi hirsutula cinerea; foliis spathulatis deorsum attenuatis; pedunculis terminalibus demumque lateralibus sæpius bifurcatis calyce fructifero longioribus; capsula ovali. — Sandwich Islands: Oahu, Macrae, Nuttall, Remy, no. 425. Sand-hills of Maui, Dr. Pickering and Mr. Breckenridge. Kauai, Nuttall. Very much branched; the leaves soon revolute, 4 – 6

lines long. Flowers small. Flower-stalks in fruit from 3 to 6 lines in length, divergent.

+— +— Hispida: sepala sursum vix ampliata.

7. N. **HISPIDA**: setis albis rigidis undique hispida; foliis oblongo-linearibus seu spathulatis; floribus terminalibus demum lateralibus subsessilibus sæpe geminis vel subscorpioideo-seriatis; sepalis angustissime linearibus; capsula oblonga. *N. Jamaicensis?* Engelm. & Gray, Pl. Lindh. 1. no. 130, non Linn. *N. dichotoma,* Torr. Bot. Mex. Bound. Surv. p. 147, excl. var. *N. biflora,* var. *spathulata,* Torr. in Pacif. R. R. Surv. 5. p. 362. Texas and the Mexican borders of the Rio Grande; Coll. Berlandier, no. 2385, 2443, 2486, and perhaps 1420; Drummond, III. no. 195; II. 309; Lindheimer, no. 130, and in later collections; W. Texas and New Mexico, Wright, no. 493, 494, 495, 1585, 1586; Fendler, no. 643. Less hispid forms probably referable to this species are from New Mexico or Arizona, no. 1584, Wright; from the mountains of San Antonita, New Mexico, Dr. Bigelow, and the same from Fort Yuma, California, Major Thomas, and from the same district by Fremont; also Arizona, Thurber.

§ 3. Folia haud decurrentia, abrupte longius petiolata, subtus pube sericeo-villosa argenteo-incana; pedunculi cymoso-pluriflori, floribus pedicellatis pro genere maximis, corolla ¾-pollicari.

8. N. **SERICEA**, Willd.; Rœm. & Schult. Syst. 6. p. 189. *N. longiflora,* Chois. Hydrol. p. 20, t. 2, f. 2, & in DC. Prodr. Mexico: Coll. Coulter, no. 914, 915.

⁂ Species dubia.

N. **HIRSUTA**, Martens & Galeotti, ex Walp. Repert. 6. p. 565. Oaxaca, Mexico.

Borraginaceæ.

HELIOTROPIUM ANOMALUM (Hook. & Arn.): fruticosum, depressum, strigoso-incanum; foliis confertis lineari-lanceolatis basi attenuatis spathulatis; cymis pedunculatis glomerulifloris; calycis lobis inæqualibus imbricatis 2 exterioribus ovatis seu oblongis, cæteris linearibus; corollæ tubo extus strigoso-sericeo calyce bis longiore; antheris apicibus brevissime barbulatis primum cohærentibus, nuculis 4 rarius 5–6 scabris. *Lithospermum incanum,* Forst. *Pentacarya heliotropioides,* DC. — Coral Islands, and Sandwich Islands.

Var. *β.* **ARGENTEUM**: pube molliore densiore nitente incanum; floribus paullo majoribus. — Sandwich Islands.

The anomaly of five nucules to the fruit, which suggested Hooker's specific as well as De Candolle's generic name, is so far from constant, that I could not detect a single instance in a long suite of specimens, although Dr. Pickering appears from his notes to have been more lucky. I have found six nucules; but a supernumerary carpel is not so extraordinary; and this suggests that the five nucules, when this number occurs, result from the abortion of one cell or half-carpel. In all essential respects this species is a Heliotrope, in which genus even the inequality of the sepals is not altogether unexampled.

Without hesitation, we may reduce to the genus *Heliotropium* Nuttall's *Euploca* (as I had already indicated), Endlicher's *Schleidenia* (*Preslea*, Mart.), and De Candolle's *Pentacarya*, and (with Fresenius) associate *Tournefortia* with it rather than with *Ehretia*. But the plant which (in Mem. Amer. Acad. n. ser. 6. p. 403) I had inadvertently referred to *Heliotropium*, viz. *H. Japonicum*, is only a variety (with broader leaves and longer style) of Ammam's *Arguzia* (*Tournefortia Arguzia*, DC.), a connecting link between *Heliotropium* § *Heliophytum* and *Tournefortia*.

Considerations analogous to those which forbid the dismemberment of *Heliotropium*, point, though perhaps less directly, to the reunion under *Coldenia* of several plants which have been distinguished as genera.*

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* If we retain under *Coldenia* both *Stegnocarpus*, DC. and *Tiquilia*, Pers. (which is *Galapagoa*, Hook. f.), and add *Eddya*, Torr. (and even *Ptilocalyx*, Torr.), a well-marked genus, of uniform floral characters and not incongruous in habit, will be the result. Otherwise we shall have four or five genera for barely twice as many species. The genus may be thus disposed in sections: —

COLDENIA, Linn.

I. Fructus e nuculis 4 trigonis dorso convexis intus faciebus planis arcte conjunctis, crassis, crustaceis.

1. Eucoldenia, DC. Styli 2, breves. Fructus globoso-quadrilobus: nuculæ geminatim subconnatæ, demum partibiles. C. procumbens, Linn.
2. Stegnocarpus, DC., Torr. Stylus bifidus. Fructus globosus in nuculas 4 secedens. C. canescens, DC. *Stegnocarpus canescens*, Torr. in Pacif. R. R. Rep. 2, p. 169, t. 7.

II. Fructus alte quadrilobus, e nuculis 4 (vel abortu paucioribus) ovatis parvis angulo interno basi styli mediante tantum connexis, pericarpio tenui.

3. Eddya, Torr. Stylus superne bifidus. Nuculæ tenuiter crustaceæ, papilloso-scabræ. C. hispidissima, Torr. l. c., t. 9.

Cordia aspera (Forst.): pube ferruginea hirsuta, demum glabrescens; foliis membranaceis ovatis acuminatis asperulis supra glabratis, serraturis subulatis; floribus parvis cymoso-glomeratis; calyce ovato-cylindraceo ferrugineo-villoso 10-striato, dentibus 5 minimis subulatis; corollæ tubo calycem vix superante lobis æstivatione inflexis et corrugatis longiore; drupa ovata acuta nuda, putamine 1 – 2-spermo. — Tonga, Feejee, Samoan, and some of the Coral Islands. A distinct and genuine *Cordia*, but the specific name is unfortunate, for the leaves are by no means rough. — This is no. 336 of the Feejee collection of Dr. Seemann, referred by him to *C. Sprengelii*, DC., but it does not accord with Sprengel's detailed description.

Labiatæ.

Gardoquia pilosa (sp. nov.): fruticosa; foliis lato- seu rhombeo-ovatis petiolatis subserratis lineato-venosis haud coriaceis puberulis subtus vix canescentibus; verticillastris multifloris; calycis hirsuti pedicello longioris dentibus subulatis, fauce intus nuda; corollis "coccineis" pilosis calyce (semipollicari) triplo longioribus. — Andes of Peru at Baños. Resembles *G. rugosa* in the foliage, but the flowers are much larger, the corolla elongated, &c. It needs to be compared with *G. pulchella*, H. B. K.; but the branches are glabrous, and the leaves not tomentose beneath, nor coriaceous.

Sphacele hastata (sp. nov.): herbacea; foliis amplis hastatis creberrime crenulatis utrinque cauleque cano-tomentulosis, floralibus oblongo-lanceolatis sessilibus; cymis laxis multifloris thyrsum elongatum efficientibus; corollis "purpureis" tubulosis calyce triplo longiori-

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4. Tiquilia, Pers. Stylus bifidus vel divisus. Nuculæ læves, nitidæ, tenuissime crustaceæ. Embryo generis, i. e. cotyledones planæ, integræ. C. dichotoma, Lehm. C. (*Galapagoa*, Hook. f.) Darwini & fusca.

5. Tiquiliopsis. Corollæ tubus basi intus 5-squamatus. Nuculæ fere membranaceæ. Cotyledones bipartitæ, radiculæ utrinque accumbentes. Cæt. *Tiquiliæ*. C. Nuttallii, Hook. Kew Jour. Bot. 3, p. 296. *Tiquilia parvifolia*, Nutt. in herb. Hook. *T. brevifolia*, Nutt. herb. ex Torr. Bot. Mex. Bound., p. 136. *T. Oregona*, Torr. Bot. S. Pacif. Exped. (Calif. & Oregon), t. 12.

Ptilocalyx, Torr. in Pacif. R. R. Rep. l. c., t. 8, where it is admirably figured, may be regarded as a *Stegnocarpus*, with all but one of the cells of the ovary sterile, these appearing as lateral vestiges on the cross-section of the monococcous coriaceous fruit. In this view it is not likely to stand as a genus, unless *Tiquilia* also does. Those who regard the reduction here foreshadowed as too great, might be better satisfied with three genera, viz. *Coldenia*, *Ptilocalyx*, and *Tiquilia*.

bus; genitalibus sublonge exsertis. — Sandwich Islands, on Mouna Haleakala, East Maui, alt. 5,000 – 7,000 feet. A most striking and distinct species: corolla an inch long, somewhat pubescent.

PHYLLOSTEGIA, Benth. An examination of the now extant materials of this Sandwichian genus leads to the suppression of four of Bentham's species, and the establishment of as many new ones. Two of the latter constitute a peculiar section, and *P. floribunda* may be taken for another. The sections, and a key to the species, may be presented as follows: —

§ 1. GENUINÆ. Racemi verticillastriflori, nempe verticillastri 6 – 20-flori in racemo caulem terminante dispositi, vel infimi (nunc lusu omnes) axillares. Corollæ albæ.	
Calycis lobi tubo æquilongi foliacei, amplissimi: hirsutissima.	*P. vestita.*
Calycis lobi tubo pl. m. breviores:	
Fructiferi ampliati, explanato-patentes, foliacei. Pedicelli calycem sericeo-pubescentem subæquantes.	*P. grandiflora.*
Fructiferi haud explanato-patentes (*P. racemosa* forte excepta).	
Glabra: pedicelli graciles.	
Verticillastri pluriflori, haud pedunculati.	*P. brevidens.*
Verticillastri 6-flori, cymulis sæpius pedunculatis!	*P. glabra.*
Hirsutissima: pedicelli breves.	*P. hirsuta.*
Molliter pubescens seu villosa.	
Pedicelli graciles calyce sæpissime longiores: pili patentes.	*P. parviflora.*
Pedicelli calycem cum corolla strigoso-pubescentem subæquantes.	*P. clavata.*
Pedicelli brevissimi plurimi.	
Calycis lobi subulato-lanceolati tubum subæquantes.	*P. stachyoides.*
Calycis lobi ovati, obtusi, tubo breviores.	*P. racemosa.*
§ 2. LATERIFLORÆ. Racemi simpliciflori (pedicellis solitariis), breves, ex axillis foliorum inferiorum. Corollæ violaceæ, parvæ.	
Lobi calycis hirsutissimi, tubo æquilongi, lineares.	*P. floribunda.*
§ 3. HAPLOSTACHYÆ. Spica simpliciflora terminalis, nuda. Corollæ albæ, tubo longo, lobis subæqualibus crispis. Folia subtus cano-tomentosa.	
Folia basi sat cordata: calycis dentes angusti, acuti.	*P. haplostachya.*
Folia basi vix cordata: calyx repando-truncatus.	*P. truncata.*

PHYLLOSTEGIA VESTITA, Benth. (racemo laxiore folioso,) takes in *P. dentata*, Benth., racemo denso nudo, foliis floralibus plerisque calyces fructif. haud superantibus.

PHYLLOSTEGIA GRANDIFLORA, Benth. To this, I suspect, belongs Gaudichaud's *Prasium macrophyllum* also, but not Bentham's *Phyllostegia macrophylla*, at least as to Macrae's plant, from which his description is principally drawn, and which I take for a form of *P. parviflora*.

PHYLLOSTEGIA BREVIDENS (sp. nov.): glabra; foliis ovalibus argute dentato-serratis; racemo laxo brevi simplici, verticillastris multifloris; calyce quasi truncato, dentibus brevissimis obtusis erectis; corollæ tubo dorso pubescente calyce duplo longiore (semipollicari). — Hawaii, in the forest of Mouna Kea, alt. 3,000 feet. Inflorescence as in *P. grandiflora* (except in the smoothness), i. e. the pedicels sessile or nearly so; but more numerous, from 7 to 11 in each cymule.

Var. ? *β*. AMBIGUA: calyce glaberrimo magis dentato, dentibus tubo quadruplo triplove brevioribus; corollæ tubo calyce triplo longiore (subpollicari); foliis subtus nunc parce pilosis. — West Maui. This is ambiguous between *P. brevidens* and *P. grandiflora*, having the corolla about the size and shape of the latter, and most of the leaves are sparingly pilose beneath. But the latter are sharply serrate, the calyces, pedicels (about 5 in each cymule), &c. are perfectly glabrous, and the calyx-teeth, although manifest and of the same form as those of *P. grandiflora*, are much shorter and hardly spreading. There is reason to suppose that this may be the same as a specimen which Menzies collected on Maui, which is preserved in the herbarium of the British Museum, and which Bentham referred to his *P. Chamissonis*. In which case, if of a distinct species, as is likely, it should be named *P. Menziesii*.

PHYLLOSTEGIA GLABRA (Benth.): undique glaberrima; foliis ovatis serratis basi rotundatis vel truncatis; racemo laxo thyrsoideo, cymulis plerisque pedunculatis trifloris; lobis calycis parvulis breviter lanceolatis tubo dimidio brevioribus, fructiferis vix ampliatis subpatentibus; corollæ tubo calyce 2–3-plo longiore. Variat calycis lobis angustioribus acutis, seu latioribus obtusis vel obtusiusculis, fructiferis haud raro tubo æquilongis; corolla subpollicari vel dimidio minore. — Gaudichaud's plate of *Prasium glabrum* represents the largest-flowered form of this species. Bentham's *Phyllostegia glabra*, in Bot. Reg. and in Linnæa, was described from branched specimens with smaller and probably later flowers; his *P. Chamissonis*, from a larger-flowered form. The corolla varies much in size, but I have never seen it rival that of *P. grandiflora*. I am persuaded, accordingly, that Bentham's *P. Macræi* and *P. Chamissonis* must merge under the original name, *P. glabra*. The species is the only one with pedunculate cymules, except the following.

Phyllostegia hirsuta, Benth. This is known only by deflorate specimens of Macrae's collection; but it is probably of this genus.

Phyllostegia parviflora (Benth.): molliter villosula vel pubescens; foliis ovatis seu ovato-oblongis serrato-crenatis basi rotundatis cordatisve; racemo laxo glanduloso- seu viscoso-villoso; verticillastris plerumque 6-floris, pedicellis gracilibus; calycis lobis breviter lanceolatis tubo 3–4-plo brevioribus, fructiferis vix ampliatis subpatentibus; corollæ tubo puberulo calyce 2–3-plo longiore (semipollicari). — Under this I combine the following: —

Var. α. **Gaudichaudi** (*P. parviflora*, Benth.): foliis subtus molliter seu mollissime pubescentibus; racemis sæpe paniculatis; floribus parvulis; corolla gracili; pedicellis sæpius calyce (1½ lin.) multo longioribus (3–6 lin.) nunc tantum æquilongis.

Var. β. **glabriuscula** (*P. macrophylla*, Benth., præsertim pl. Macræi): foliis cauleque subpubescentibus vel glabratis; floribus majoribus; pedicellis calyce (2–3 lin.) 2–3-plo longioribus; verticillastris interdum 8-floris.

Var. γ. **mollis** (*P. mollis*, Benth.): undique mollissime velutino-pubescens, canescens; pedicellis calyce brevioribus vel subæqualibus; corolla (4–5 lin.) calyce duplo longiore.

Phyllostegia stachyoides (sp. nov.): molliter pubescens; foliis ovato-lanceolatis acuminatis vix basi subcordatis crenato-serratis; racemo denso; verticillastris 10–14-floris; pedicellis calyce brevioribus; lobis calycis glandulosi-puberuli subulato-lanceolatis tubo paullo brevioribus; corollæ pubescentis tubo calyce duplo longiore. — Hawaii, in the district of Waimea. Leaves much like those of *P. racemosa*, but tapering to an acute point, and scarcely at all cordate.

Phyllostegia clavata (Benth.): pubescens vel hirsuta pilis appressis, foliis ovatis seu ovato-lanceolatis subacutis basi rotundatis vix subcordatis crenato-serratis; verticillastris 6–14-floris, pedicellis calyce subæquilongis; lobis calycis strigosi late triangulari-ovatis obtusis tubo triplo brevioribus; corolla strigoso-pubescentis tubo calyce triplo longiore; stylo apice clavato. Variat 1. foliis glabriusculis pedicellis fructiferis 2–3-plo longioribus, 2. sericeo-villosa, canescens, lobis calycis paullo majoribus. — Style more clavate than usual at its summit, the upper lobe smaller and its stigma often abortive.

Phyllostegia racemosa (Benth.): villosula seu tomentoso-pubescens; foliis oblongis ovato-lanceolatisve obtusis basi sæpissime cordatis crenatis; verticillastris 8–12-floris; pedicellis brevissimis; lobis calycis

tomentulosi ovatis obtusissimis tubo dimidio brevioribus, fructiferis auctis patentibus; corolla pubescente calyce duplo longiore. — Branches of the style often unequal, the upper one being smaller, as in the preceding.

PHYLLOSTEGIA HAPLOSTACHYA (sp. nov.): cano-tomentosa; foliis cordato-oblongis seu cordato-lanceolatis crenatis; verticillastris bifloris; floribus subsessilibus in spicam simplicem virgatam digestis; calycis dentibus lato subulatis erectis tubo 3–4-plo brevioribus; corollæ tubo longe exserto, lobis crispis. — Maui, on the sands of the low isthmus. Also gathered by Remy on Hawaii. Calyx 3 or 4 lines long, cylindraceous, a little curved, and the flower horizontally spreading in anthesis. Corolla white; the tube 8 or 9 lines long, the lips less unequal than in other species, the upper one and the three lobes of the lower lip rotund and with strongly undulate-crisped margins. Style of the genus. So of the fruit, which is apparently drupaceous when fresh, but is included in the ovoid and nearly closed fructiferous calyx.

Var. β. LEPTOSTACHYA: foliis angustioribus e basi minus cordata, pagina superiore calycibusque minutim tomentulosis nec incanis; floribus inferioribus dissitis. — On barren ridges of Kauai; in flower.

PHYLLOSTEGIA TRUNCATA (sp. nov.): tomentulosa; foliis lanceolatis crenulatis basi truncatis vel subcordatis subtus incanis; verticillastris bifloris; floribus in spicam simplicem digestis brevissime pedicellatis, infimis dissitis; calyce puberulo glanduloso repando-truncato, dentibus brevissimis latis obtusissimis; corollæ tubo elongato, lobis rotundatis subæqualibus crispis. — Maui, Coll. Remy, no. 395. Closely related to the preceding. The two would be taken for the type of a distinct genus; but I find no sufficient reason for their separation.

PHYLLOSTEGIA FLORIBUNDA (Benth.): villoso-hirsuta; caule rigido (bipedali); foliis ellipticis seu oblongo-ovatis acuminatis crenato-serratis basi rotundatis vel obtusis; racemis brevibus plurifloris ex axillis fol. inf., rhachi pedicellis filiformibus calycibusque patenti-hirsutissimis; lobis calycis linearibus tubo suo et corollæ "late violaceæ" subæquilongis. — Hawaii, in woods of the district of Puna. Before known only from the specimen gathered (probably on Hawaii) by Nelson in Cook's last voyage, and preserved in the Banksian herbarium. Achenia fleshy, projecting from the open mouth of the fructiferous calyx.

STENOGYNE, Benth., is the other Labiate genus peculiar to the Sandwich Islands. In all the species the corolla is more or less hairy or downy externally towards its summit, while the lower part of the tube is apt to be glabrous or glabrate. The color is mostly rose or pink. The lips, indeed, are often "subæqual"; but it is the upper (not the lower) lip which surpasses the other, sometimes strikingly so when fully developed. This is especially the case in the small-leaved section, where the erect or falcate upper lip, produced much beyond the short and 3-cleft lower one, calls to mind the corolla of a *Castilleia.* The bearded annulus is wanting in *S. rotundifolia*, *S. cordata*, and nearly so in what I take to be *S. macrantha*, therefore probably in *S. sessilis.* The stamens equal the upper lip, or are exserted beyond it. The following conspectus of the species will be convenient.

* *Corolla exannulata. Verticillastri sæpius 6-flori.*

Folia longius petiolata: nervi calycis obsoleti.
Hirsuto-hispida: calyx 5-fidus: cor. lab. superius productum. *S. macrantha.*
Glabrata: calyx breviter dentatus: corollæ labium superius inferiori vix longius: filamenta villosa! *S. rotundifolia.*
Folia vix petiolata, glabra: calyx nervosus, 5-lobus.
Folia subpetiolata: calycis lobi acuti. *S. cordata.*
Folia arcte sessilia: calycis lobi lati obtusi. *S. sessilis.*

* * *Corolla villoso-annulata.*

Folia majora, longius petiolata: verticillastri sæpius 6-flori: labia corollæ subæquilonga vel superius paullo longius.
Calycis nervi obscuri, dentes breves obtusi. Folia submembranacea.
Subglabra, caule angulis hirsutis: folia rotundata: pedicelli calycem vix æquantes. *S. calaminthoides.*
Glabra: folia ovata, acuta: pedicelli calyce longiores. *S. scrophularioides.*
Calycis præsertim fructiferi nervosi, lobi acuti: folia rigida.
Erecta: folia ovata seu oblonga. *S. rugosa.*
Procumbens: folia oblongo- seu lanceolato-linearia: verticillastri biflori. *S. angustifolia.*
Folia parva, plerumque petiolata: caules ramosissimi diffusi: verticillastri biflori: corollæ (viridulæ) fauce minus ampliatæ, labium superius insigniter productum: stamina exserta. (*Microphyllæ.*)
Glabra: folia acute serrata vel incisa, basi angustata. *S. microphylla.*
Hispida: folia oblonga, obtusa, grosse crenata. *S. crenata.*
Villoso-pubescens: folia rotundata, basi truncata vel subcordata, grosse crenata. *S. diffusa.*

STENOGYNE MACRANTHA (Benth.?): pilis patentibus undique molliter hispida; foliis subrotundis vel ovatis crenatis basi sæpius cordatis submembranaceis longiuscule petiolatis; verticillastris 6-floris; pedicellis calyce 5-lobo æquilongis, utrisque hispidis; filamentis subnudis;

corolla (subpollicari!) fere exannulata extus sericea.—The above character is drawn from no. 381 of Remy's collection, from Hawaii. It does not accord in several particulars with the character of Bentham's *S. macrantha*, drawn from a single specimen collected by Macrae. That is stated to have corollas an inch and a half long, "labio superiore vix inferiore breviore." In Remy's specimens the lower lip is decidedly shorter than the upper, the dilated orifice oblique.

STENOGYNE ROTUNDIFOLIA (sp. nov.): caulibus basi suffruticosis acute tetragonis ad angulos præsertim cum petiolis retrorsum hirsutis; foliis glabratis rotundis crenatis basi truncatis vix subcordatis pollicaribus; verticillastris 6-floris; pedicellis petiolo dimidio brevioribus calyce glabro breviter dentato subæquilongis; filamentis villosis; corolla (10 lin. longa) exannulata intus villosa. — Mouna Haleakala, E. Maui.

STENOGYNE CORDATA (Benth.): glabrata vel præter nodos barbatos glabra; foliis subpetiolatis ovatis basi pl. m. cordatis (pollicaribus) crenulatis; verticillastris 2–6-floris; pedicellis brevissimis; calyce inæquali, lobis acutis, anticis tubo subæqualibus; corolla exannulata, labiis fere æquilongis. — Hawaii and W. Maui.

STENOGYNE SESSILIS, Benth., nearly related to the last, has been found only by Menzies. The specimens in the Banksian and Hookerian herbaria have larger, rounder, more rugose, and more closely sessile leaves than *S. cordata*, the stem hairy on the angles, the lobes of the calyx broad and obtuse, and the downy corolla larger.

STENOGYNE CALAMINTHOIDES (sp. nov.): subglabra; caulibus decumbentibus vel repentibus tetragonis ad angulos retrorsum hirsutis; foliis rotundo-ovatis crenatis basi subcordatis truncatisve longiuscule petiolatis subflaccidis (1–2-poll.); verticillastris 6–8-floris; pedicellis calycem vix æquantibus; dentibus calycis obtusis brevissimis; corollæ elongatæ superne puberulæ (ultrapollicaris) labiis fere æquilongis. — Hawaii, in the forests of Mouna Kea, &c. Allied both to *S. rotundifolia* and to *S. scrophularioides*.

STENOGYNE SCROPHULARIOIDES (Benth.): glabra, divaricato-ramosa; foliis ovatis acutis serratis basi rotundatis vel truncatis subflaccidis, petiolo gracili; verticillastris sæpissime 6-floris; pedicellis calyce breviter dentato longioribus; corollæ superne pubescens labiis subæquilongis. — Hawaii.

Var. β. foliis oblongo-ovatis sæpius acuminatis argutius serratis floribusque majoribus. *S. Nelsoni*, Benth. *Phæopsis montana*, Nutt. — Hawaii and Oahu.

Stenogyne rugosa (Benth.): sæpius glabra vel glabrata; foliis coriaceis rigidis oblongis seu ovato-oblongis basi rotundatis vel truncatis petiolatis crenato-serratis reticulatis nunc rugulosis; verticillastris plerumque 6-floris; pedicellis calyce brevioribus; calyce subinæquali, lobis sæpius mucronato-acutis vel acutissimis tubum subæquantibus; corollæ breviusculæ labio inferiore paullo breviore. — Variat, 1. fere omnino (corolla excepta) glaberrima, lævis, seu pedicellis calycibusque hirsutulis: 2. hirsutula vel hispidula, foliis nunc rugosis asperulis: 3. pube brevi molli induta, verticillastris 6 – 10-floris. — Hawaii, brought by most collectors.

Stenogyne angustifolia (sp. nov.): glaberrima; caulibus filiformibus sarmentosis sæpius procumbentibus; foliis coriaceis oblongo-linearibus seu lineari-lanceolatis crenulato-serratis basi in petiolum angustatis; verticillastris bifloris; floribus fere *S. rugosæ*, lobis calycis inferioribus tubo paullo longioribus; corolla glabrata. — Hawaii, in the district of Waimea. Possibly an extreme form of the preceding.

Stenogyne microphylla (Benth.): glabra, diffuso-ramosissima, subscandens; foliis parvis (¼ – ½-poll.) oblongis grosse serratis vel incisis basi in petiolum marginatum angustatis; verticillastris bifloris; corolla extus puberula, labio superiore falcato longe producto; staminibus exsertis. — Hawaii.

Stenogyne crenata (sp. nov.): hispida, ramosissima, foliosissima; foliis parvis oblongis seu ovalibus obtusis grosse crenatis breviter (nunc brevissime) petiolatis; verticillastris bifloris; corolla extus hispida, labio superiore longiuscule producto; staminibus exsertis. — Maui, on Mouna Haleakala. Differs from the preceding in the hispid hairiness, which is retrorse and aculeolate on the acute angles of the stems, in the blunt and crenate leaves, less unequal lips of the corolla, &c.

Stenogyne diffusa (sp. nov.): molliter villoso-pubescens, divaricato-ramosissima; foliis parvis rotundis grosse crenatis basi truncatis vel subcordatis (1½ – 2 lin. latis) petiolatis; verticillastris bifloris; calycis lobis obtusis; corolla extus pubescente, labio superiore longe producto; staminibus exsertis. — Hawaii, in forests of the district of Waimea.

A specimen of what may be still another species of this small-leaved section was gathered on East Maui, with ovate-subcordate or deltoid leaves, incisely lobed, and with the diffuse branches cinereous-pubescent; but the flowers and fruit are unknown.

Teucrium argutum, R. Br. var. pinnatifidum: foliis laciniato-pinnatifidis fere bipinnatifidis. — Hunter's River, New South Wales.

The no. 359 of Seemann's Feejee collection, inadvertently named *Coleus atropurpureus*, is *Plectranthus Forsteri*.

Acanthaceæ.

Eranthemum laxiflorum (sp. nov.): glaberrimum; foliis ovato-seu lanceolato-oblongis sæpius acuminatis acumine obtuso; pedunculis axillaribus petiolo longioribus cymoso-tri-multifloris; bracteis oblongis parvis herbaceis; pedicellis calyce longioribus; laciniis calycis setaceo-subulatis tubo brevissimo pluries longioribus; corolla "cærulea" hypocraterimorpha, lobis ovalibus. — Sandalwood Bay, &c., Feejee Islands. A showy species, of the same group as *E. bicolor;* "shrub six feet high, ornamental." The color of the flowers, "blue," is stated on the authority of Dr. Pickering's notes. This and the following mixed were distributed by Dr. Seemann under the name of "*Graptophyllum hortense*," — which throws much doubt on the assigned difference in color.

Eranthemum insularum (sp. nov.): glabrum; foliis ovatis lanceolatisve obtuse acuminatis; pedunculis axillaribus seu ramos terminantibus brevibus 1-3-floris; bracteolis minutis; calycis laciniis subulatis tubo duplo triplove longioribus; corolla "purpurea" infundibuliformi, lobis oblongis. — Feejee Islands, "frequent and sometimes cultivated; an ornamental shrub, six feet high, with purple flowers." Vavau and Lifuka, Friendly Islands, Prof. Harvey. Perhaps varying into the preceding. Is *Justicia longifolia*, Forst. (*J. sinuata*, Soland., appended by Nees to *Anthacanthus*) a congener of the above?

Chætacanthus repandus: glaber, elatus (fruticosus?); foliis ovato-lanceolatis seu oblongis acumine obtuso repandis sinuatisve membranaceis; pedunculis cymoso-paucifloris; corolla extus calyceque minutim pubescentibus. *Justicia repanda*, Forst.? *Eranthemum repandum*, Rœm. & Schult.? *Anthacanthus repandus*, Nees in DC.? — Ovolau, Feejee Islands. The small flowers, anthers, &c. correspond with the Cape species, upon which Nees founded his *Chætacanthus*.

Dicliptera clavata, Juss. Our materials from Tahiti barely suffice to show that the plant is of this genus. The apparent contradiction in Vahl's description, which puzzled Nees (Prodr. 11. p. 490), is readily harmonized by noting that the word "bracteis" in the diagnosis refers to the involucral valves, but in the appended remarks it applies to those bracts which subtend the ramifications.

Gesneriaceæ, Cyrtandreæ.

Of *Cyrtandra biflora*, Forst., from Tahiti, the original of the genus, I have nothing to remark. The species inhabiting the Sandwich Islands I have been able to study under favorable circumstances; the substance of the revision is presented in the following analysis and diagnoses.

Cyrtandræ Sandwicenses.

1. Flores mediocri, ultra-semipollicares.

Folia cordata, ampla.	
Calyx rotatus, lobis ovatis: ovarium villosum.	*C. cordifolia.*
Calyx campanulatus, lobis lanceolatis: ovarium glabrum.	*C. platyphylla.*
Folia utrinque acuta vel acuminata.	
Calyx crateriformis breviter 5-lobus.	*C. Pickeringii.*
Calyx cylindricus, breviter 5-lobus.	*C. grandiflora.*
Calyx campanulatus vel cylindraceus, 5-fidus.	
Pedunculus communis brevissimus.	*C. paludosa.*
Pedunculus pedicellis æquilongus.	*C. triflora.*
Calyx 5-partitus: folia utrinque viridia.	Var. *lysiosepala.*
Calyx 5-partitus: folia subtus ferrugineo-sericea.	*C. Lessoniana.*

2. Flores parvi, haud semipollicares.

Folia elliptica, subtus canescenti-velutina: calyx 5-fidus.	*C. Garnotiana.*
Folia lato ovata, subtus pruinoso-canescens; calyx 5-partitus, lobis lanceolatis.	*C. Macræi.*
Folia utrinque viridia, oblonga seu lanceolata: calyx 5-partitus, lobis setaceis elongatis.	*C. Menziesii.*

CYRTANDRA CORDIFOLIA (Gaud.): villosissima; foliis rotundo-ovatis cordatis acuminatis argute dentatis supra hirsutis subtus calycibusque dense tomentoso-villosis subincanis (5 – 7-poll.); pedunculis plurifloris; calyce rotato angulato-quinquefido fere æquali corollam subæquantibus, lobis late ovatis acuminatis; ovario cum stylo brevissimo villoso. — Oahu. Gaudichaud's plate pretty well represents this species, except that the shaggy pubescence is omitted, the leaves are not large enough, and the rotate calyx not expanded.

CYRTANDRA PLATYPHYLLA (sp. nov.): foliis subrotundo-cordatis breve acuminatis (5 – 9 poll. latis) argute denticulatis supra hirsutulis subtus canescenti-pubescentibus, costis cum petiolis ramis calycibusque pube ferruginea villosis; pedunculis plurifloris; calyce inæqualiter quinquefido, lobis lato-lanceolatis corolla brevioribus; ovario cum stylo gracili glaberrimo. — Hawaii, in forests. Stem 10 feet high.

CYRTANDRA PICKERINGII (sp. nov.): ferrugineo-villosa; foliis oblongo-lanceolatis utrinque acuminatis subserrulatis supra hirsutis subtus (præter costas villosas) fulvo- vel canescenti-pubescentibus; pedunculis 3 – 5-floris; calyce crateriformi subæqualiter breviter 4 – 5-lobo corolla breviore, lobis late deltoideis. — Mountains of Oahu. Except for the calyx (which is ampliate in the manner of *C. cordifolia*, but crateriform or cyathiform rather than rotate, and much less lobed), and the soft fulvous down of the lower surface of the leaves, this might be taken for a variety of the next species.

CYRTANDRA TRIFLORA (Gaud.): glabrata vel primum ferrugineo-hirsuta; foliis oblongis seu ellipticis utrinque acutis vel acuminatis serrulatis serratisve utrinque viridibus; pedunculis brevibus 2 – 5-floris; calyce subæqualiter 5-fido cylindraceo, lobis lato-lanceolatis corolla brevioribus.

Var. *α*. GAUDICHAUDI: ramis foliisque præter costam venasque paginæ inferioris ferrugineo-pubescentes glabris; calycis lobis tubo æquilongis. — Oahu, Hawaii.

Var. *β*. ARGUTA: ramulis cum inflorescentia ferrugineo-hirsutis; foliis majoribus ovalibus caudato-acuminatis crebre argutissime serratis hirsutulis; calycis (etiam fructiferi hirsuti) lobis tubo brevioribus. — Hawaii, in mountain forest.

Var. *γ*. LYSIOSEPALA: calyce fere 5-partito; cæt. var. *β*. — Hawaii, in deep forest.

CYRTANDRA GRANDIFLORA (Gaud.): foliis oblongis seu ovatis utrinque acuminatis subintegerrimis glabratis subtus pallidis puberulis, costa venis petioloque pube brevissima ferrugineis; pedunculo 1 – 2-floro bracteis foliaceis; calyce cylindrico breviter 5-lobo hinc sæpe profundius fisso corolla glabra paullo breviore. — Oahu. Calyx, when well developed, an inch long; teeth three lines long. To this probably belong *C. Endlicheriana*, Nees, and *C. Ruckiana*, Meyen and Walpers.

CYRTANDRA PALUDOSA (Gaud.): "suffruticosa," glabra; foliis oblongis sublanceolatisve utrinque acuminatis serratis subtus pallidis; pedunculis brevissimis nudis 1 – 5-floris; calyce cylindraceo-campanulato inæqualiter 5-fido, lobis triangulari-acuminatis, anticis tubo æquilongis; corolla glabra; fructu olivæformi. — This is most related to *C. grandiflora*, but is glabrous in the adult state, only the nascent leaves, &c. ferrugineous-pubescent.

CYRTANDRA LESSONIANA (Gaud.): foliis oblongis utrinque sæpius acuminatis denticulatis supra hirsutulis subtus cum ramis pedunculisque pube adpressa ferruginea sericeis; pedunculis elongatis 1 – 3-floris; bracteis lanceolatis; calyce 5 – 6-partito; lobis ovatis seu ovato-lanceo-

latis corolla extus sericeo-villosa brevioribus vel demum æqualibus laxis; fructu ovato. — Oahu.

Var. *β*. calycis lobis elongato-lanceolatis; corolla subglabrata. — West Maui.

The deeply-parted divisions of the calyx are at first considerably shorter than the corolla, but they enlarge with age: at first silky-villous and ferrugineous, when old they are glabrate; they are not always so broad as Gaudichaud represents them, nor with such undulate reflexed margins; sometimes they become merely broad-lanceolate; in the variety from Maui they are still narrower, and then occasionally six. Corolla white or greenish, as in all these species.

CYRTANDRA GARNOTIANA (Gaud.): foliis ellipticis vel obovatis utrinque sæpius anguste acuminatis denticulatis supra hirsutulis subtus cum inflorescentia ramisque canescenti-velutinis; pedunculis gracilibus 3–5-floris; bracteis parvis; calyce campanulato subæqualiter 5-fido, lobis triangularibus tubo subæquilongis corolla extus hirsuta (4–5 lin. longa) subdimidio brevioribus. — Oahu. One of the small-flowered species. The fruit is figured by Gaudichaud as ovate.

CYRTANDRA MACRÆI (sp. nov.): foliis lato-ovatis acuminatis denticulatis supra glabris subtus ramulisque novellis pruinoso-incanis, venis pubescentibus; pedunculis brevissimis cymoso-multifloris; calyce æqualiter 5-partito corolla pruinosa fructuque ovoideo multo breviore, lobis e basi lata lanceolatis. — Oahu, gathered by Macrae (1825), Gaudichaud (in voyage of the Bonite), and by Brackenridge. "Shrub 10 feet high," but the branches collected are herbaceous. Leaves 4 to 8 inches long by 3 to 6 wide. Bracts minute. Flowers very small for the genus; corolla 4½ lines long. Stamens not examined, only a single flower having been seen. Pistil of the genus. Immature fruit 4 lines long, conical-ovoid or ellipsoidal, probably more or less fleshy.

CYRTANDRA MENZIESII (Hook. & Arn. Bot. Beech., p. 91, adn.): subglabra; foliis quaternis (an semper?) oblongis seu lanceolatis utrinque acuminatis serrulatis; pedunculis petiolo brevioribus umbellato-plurifloris; calyce 5-partito, lobis elongatis subulato-setaceis corolla vix semipollicari paullo brevioribus; fruct. fere *C. Macræi*. — Not in our collection, but found by Gaudichaud in the voyage of the Bonite.

As to the species of the Feejee Islands, the collection of the American Expedition contains only three or four of the eight enumerated by Dr. Seemann, the characters of which he is about to publish.

Five hundred and first meeting.

December 9, 1861. — MONTHLY MEETING.

The VICE-PRESIDENT in the chair.

The Corresponding Secretary read letters of acceptance from Chief Justice Bigelow, Commander J. M. Gilliss, U. S. N., Professor James Hadley, Jr., Ezra Abbot, Truman H. Safford, and Jules Marcou, who had been notified of their election into the Academy.

Professor Cooke was added to the Committee on Captain Anderson's paper, on motion of Professor Peirce.

Messrs. Peirce, Bond, Lovering, Winlock, J. I. Bowditch, and B. A. Gould were appointed a committee to wait upon Mr. Alvan Clark, and, with his consent, to examine and report upon a new and large telescope said to have been constructed by him.

Professor Peirce presented the following

Abstract of a Memoir upon the Attraction of Saturn's Ring.

The general formula for the attraction of the ring is expressed by the aid of elliptic integrals.

When the attracted point is in the plane of the ring, the formula of attraction assumes the simple form,

$$R = R_2 - R_1,$$

in which

$$R_m = K\left[\frac{r+\rho_m}{r} E^1 c_m - \frac{r^2+\rho^2_m}{r\,(r+\rho_m)} F^1 c_m\right].$$

In this formula

$r =$ the distance of the attracted point from centre of ring,
$\rho_2 =$ the exterior radius of the ring,
$\rho_1 =$ the interior radius of the ring,
$c^2_m = \frac{4\,r\,\rho_m}{(r+\rho_m)^2},$

br. log. $K = 7.317409$.

When the point is very near the inner or outer circumference of the ring, it is necessary to substitute for c^2_m the more exact value,

$$c^2_m = \frac{4\,r\,\rho_m}{(r+\rho_m)^2 + b^2}$$

in which $2\,b =$ the thickness of the ring.

If we put

$$\sin i_m = c_m$$

this value gives,

$$\cos i_m = \tfrac{1}{2}\pi - i_m = \frac{\sqrt{[(r-\rho_m)^2 + b^2]}}{r+\rho_m} = w_m,$$

$$E^1\,c_m = 1,$$

$$F^1\,c_m = \log\frac{4}{w_m}.$$

When the attracted point is near the plane of the ring, the attraction parallel to this plane is given by the preceding formula, and that perpendicular to the ring is given by the formula,

$$Z = Kz\,(V_2 - V_1),$$

in which

$$V_m = \frac{1}{r+\rho}\,F^1\,c_m - \frac{1}{r-\rho}\,E^1\,c_m$$

and $z =$ the distance of the attracted point from the plane of the ring.

It appears from these formulæ, that, if Saturn's ring were one solid ring of uniform thickness, its tenacity must be sufficient to sustain, in the form of a wire, on the surface of the earth, a weight equal to six thousand miles of its own length; that is, it must be six hundred times stronger than the strongest iron wire. The demand for a strength which so immensely surpasses all experience, is a powerful argument against this constitution of the solid ring.

If the ring were subdivided into smaller rings, and if the plane of either of the secondary rings were not to pass through the centre of Saturn, this ring would vibrate back and forth perpendicular to its plane, and the whole time of oscillation would be the same as that of its revolution about the primary. The different rings would consequently have different times of vibration, so that they must constantly be in opposite phases of vibration. The average extent of vibration for all the rings could not then be materially different from the average apparent thickness of the whole ring.

The following preliminary notice of a memoir was presented: —

On the Double Salts of Cyanide of Mercury, by WILLIAM P. DEXTER.

An investigation of some of the compounds of cyanide of mercury having already occupied me for a considerable time, I would beg leave to communicate the conclusions at which I have thus far arrived; and would state that I am still engaged in the prosecution of this subject.

For several of these compounds my analyses have led me to infer a composition differing from that assigned to them by previous investigators. For example, the salts of cyanide of mercury with the chlorides of nickel and cobalt, to which Poggiale * gives the formulæ

$$\mathrm{NiCl,\ HgCy,\ 6\ HO,}$$
$$\mathrm{2\ CoCl,\ HgCy,\ 4\ HO,}$$

I have found to be expressed by

$$\mathrm{NiCl,\ 2\ HgCy,\ 7\ HO,}$$
$$\mathrm{CoCl,\ 2\ HgCy,\ 7\ HO,}$$

thus removing a difference which was certainly not to be expected in bodies so nearly related, and showing their conformity in constitution with the other salts of this class.

The salt to which Desfosses † gives the formula

$$\mathrm{KCl,\ 2\ HgCy,\ HO,}$$

I find to contain *two* equivalents of water; and for the analogous salt with chloride of barium, which, according to Poggiale, contains but 4 HO, I get the formula

$$\mathrm{BaCl,\ 2\ HgCy,\ 6\ HO;}$$

it then agrees in composition with the corresponding salts of strontium and calcium.

The cyanide unites also with chlorides of the type $\mathrm{R_2\,Cl_3}$; I have formed and analyzed the compound with perchloride of iron. Its formula is

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* Compt. Rend., XXIII. 762.

† Gmelin, Handb. d. Org. Ch. Bd. I., S. 417. The original memoir in Journ. Chim. Méd., VI. 261, is not accessible to me.

$$Fe_2Cl_3,\ 4\ HgCy,\ 7\ HO.$$

I hope to get similar salts with Al_2Cl_3, Be_2Cl_3, and perhaps with Cr_2Cl_3.

For the salt of cyanide of mercury and chromate of potash, first described by Caillot and Podevin,* Rammelsberg † has found the formula

$$2\ (Ko,CrO_3),\ 3\ HgCy,$$

which was changed by Poggiale ‡ to

$$(Ko,CrO_3),\ 2\ HgCy.$$

An analysis of this salt has given me results agreeing very nearly with those of Rammelsberg, with the addition of one equivalent of water, which has been hitherto overlooked. Its formula would then be

$$2\ (Ko,CrO_3),\ 3\ HgCy,\ HO,$$

The analyses of the compound which has been mentioned as consisting of

$$BaCl,\ 2\ HgCy,\ 6\ HO$$

have shown that *the composition of this salt is not constant, and is not in exact accordance with the laws of chemical proportion.* The above formula requires 16.73 Ba, and 48.77 Hg in the hundred. In the salt as I have obtained it, the barium is always deficient in quantity and the mercury in excess. The barium has been found as low as 13.4, and I have never found it higher than 15.69; while the mercury varied from 54.3 to 50.5. In general, the smaller the excess of chloride of barium in the solution from which it crystallizes, the less barium and the more mercury will be found in the salt. In some of the cases, those which gave the extreme numbers, this may very probably be owing to a mechanical admixture of cyanide of mercury, the crystals of which formed at the same time with those of the double salt, and, as I shall on another occasion show, cannot always be distinguished from them. It is possible, too, that there may be a compound of chloride of barium with more than two equivalents of cyanide of mercury, and that the analyses were made upon mixtures of the two salts. But the existence of such a body has never been shown, nor do we know an instance of a chloride, iodide, or bromide combining with cyanide of mercury in any other proportion than one equivalent to two. The salts of chloride of nickel and chloride of cobalt which I have mentioned, and a salt said, also on the authority of Poggiale, to be composed of

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* Berzelius, Jahrsb., VI. 183.

† Pogg. Ann., Bd. XLII. S. 131, and Bd. LXXXV. S. 145.

‡ *Loc. cit.*

$$2\ NH_4Cl,\ HgCy,$$

are the only exceptions to this statement which I have been able to find. In other instances, as in that of the subjoined analysis, which was made upon large, perfectly defined, and carefully chosen crystals, deposited by spontaneous evaporation from a liquid containing a considerable excess of chloride of barium, such an explanation seems to me entirely inadmissible. The analysis gave

	Calculated.	Found.
Ba	16.73	15.69
Cl	8.66	8.12
2 Hg	48.77	51.32
2 Cy	12.68	13.34
6 HO	13.17	11.53 (by difference).

A direct determination of the water upon another portion gave 6 HO = 11.63.

The above is one of thirteen analyses of this salt, and is chosen for no other reason than that the crystals were carefully selected, and that its accuracy is vouched for by the agreement of the direct determination of the water with the determination by difference. The water was determined directly in two other cases, and the variation from the determination by difference found to be less than one tenth of one per cent. To control still further the exactness of the analyses and the purity of the double salt, the chlorine was in one instance determined; the analysis gave 7.98, the quantity required by the barium present was 8.01. The cyanide of mercury used was also analyzed by the same process, and with the addition of the same reagents which had been employed in the analysis of the double salt; the result differed from the calculated composition only by one in the hundredths of a per cent. In all the analyses the deviation from the composition of the theoretical or *normal* salt is unmistakable, and is the more striking when the perfect crystalline structure of the body is considered. I have observed a similar abnormal composition in the salt of chloride of strontian, while the salt of chloride of potassium, for example, even when crystallized in the most confused manner, has a composition agreeing completely with theory.

Reserving further discussion for another occasion, when the subject shall have been more thoroughly investigated, the following is the view which I am at present inclined to take of this, as well as of some other cases of similar nature.

The body in question may be regarded as composed of *normal* salt, of definite atomic constitution, to which is added a certain *excess*, variable in amount, of cyanide of mercury; *which latter is not combined chemically with the nominal salt, but enclosed like a foreign body in the interstices of its crystalline structure.* If this view be correct, the water and barium should be present in the *abnormal* in the same relative proportion in which they exist in the *normal* salt; and if the *excess* of cyanide of mercury be deducted from the total salt analyzed, the barium found should be in the same proportion in the residue as it is in the *normal* salt. The one of which conditions is virtually included in the other.

The abnormal crystals of this salt, which I have examined, agree pretty well with these conditions. Omitting details for the present, it may be stated that the water thus calculated on the barium found is in general deficient by about 0.5 per cent; it agreed in one case very nearly with the theory, and was found once to be 0.7 per cent in excess. In this case unusual and perhaps inadmissible means had been taken to remove adhering moisture. The salt is permanent in a not too dry air, but in the air of a heated room, or in air kept dry by means of sulphuric acid, it effloresces and loses at last nearly the whole of its water of crystallization. When it is considered that the only means we possess of drying such a salt without expelling the water essential to its crystalline constitution is the mechanical operation of pressure between paper, the above-mentioned deviation from theory, amounting to 6 or 7 milligrammes on the quantity taken for analysis, may not be thought to exceed the limits of the unavoidable errors of observation.

Should this view be borne out by further investigation, and should it be admitted that crystallized bodies may hold certain of their constituents, or even foreign substances, in a state not of chemical but of physical or *crystallographic* combination, this property would serve to explain the apparent inexactness of certain chemical analyses, as well as facts in mineralogy which at present are not reconcilable with the laws of atomic proportion; and would show that, where a deviation from these laws is coexistent with crystalline structure, such deviation may be merely apparent, and the crystalline form in reality dependent upon the presence of a body possessed of a definite atomic constitution.

Dr. C. T. Jackson exhibited a fragment of the Dhurmsala meteorite, which had been presented to the Boston Society of Natural History by the Governor-General of India.

Mr. Safford announced the results of his calculations on the perturbations of Uranus.

Five hundred and second meeting.

January 14, 1862. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read various letters relative to the exchanges of the Academy.

F. H. Storer having declined to serve on the Rumford Committee, Prof. Winlock was chosen to fill the vacancy.

The Report to the United States Government on the Physics and Dynamics of the Mississippi, by Capt. Humphries and Lieut. Abbot, of the U. S. Topographical Engineers, received by the Academy from the authors, was referred to Professor Peirce.

W. P. Dexter communicated the following paper, viz.: —

Remarks upon the Recent Determinations of the Atomic Weight of Antimony.

The atomic weight of antimony has been successively investigated by Berzelius, Kessler, Schneider, H. Rose, myself, and Dumas. Very recently Kessler has revised and repeated his determinations, and arrived at a result which "completely agrees"[*] with that previously obtained by me. I have hitherto abstained from making any remarks upon these researches, or from entering upon any defence of my own work, from the conviction that a determination of an atomic weight, if correct, would certainly be in the end received, and if incorrect, would as certainly be superseded by a better.

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[*] "Welches (das Atomgewicht) sich nun nach meinen späteren Versuchen als durchaus ubereinstimmend mit dem von Dexter gefundenen herausstellt." — Pogg. Ann., Bd. CXIII. S. 134.

The equivalent found by Berzelius* was 129, when reduced to the scale on which $H = 1$, and it is remarkable as being the only instance in which a grave error has been detected in the numerous determinations to which he devoted a large part of his life.

Passing over the equivalent of Berzelius, which is now admitted to be altogether too high, the other determinations may be divided into two classes; those of Schneider and H. Rose, which place the equivalent at about 120, and those of Kessler, Dumas, and myself, which give a number not varying much from 122. Kessler claims to have been the first to show the error in the equivalent which had been universally adopted on the authority of Berzelius. His earlier experiments gave 123.58 to 123.84 for the atomic weight.†

A few months later appeared the elaborate research of R. Schneider of Berlin.‡ A native sulphide of antimony, said by him to be free from appreciable quantities of arsenic and the metals by which it is usually accompanied, served as the basis of this work. The sulphide was reduced, at a temperature just sufficient to fuse it, by a slow stream of pure hydrogen. The loss of weight, after applying small corrections for a minute quantity of quartz present, for a portion of the antimony volatilized, and for a trace of sulphur retained by the reduced metal, gave the necessary data for the calculation of the atomic weight.

It is an invidious task, especially for a fellow-laborer, to examine into the causes of error in a work so elaborately and conscientiously executed. The results show, however, and Schneider himself admits the presence of, some constant error, in consequence of which the proportion of antimony in the sulphide seemed to increase regularly with the quantity of material operated upon. So that those determinations gave the highest atomic weight in which the largest quantity of sulphide was employed. I am inclined to think that the error may have arisen in part from the action of the flame upon the glass of the tube in which the reduction was effected. It is stated by Stas,* that "all kinds of glass, when long exposed to a red heat in contact with the flame of alcohol or of gas, lose slowly, but continuously, in weight." This loss would have apparently increased the amount of sulphur in the sulphide, and so have led to a too low valuation of the atomic weight. That this is not the only constant error is shown by the fact that those determinations gave the highest equivalent in which, the quantity of substance being the largest, the glass was longest exposed to the action of the flame.

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* Schweigg. Journ., Bd. VI. S. 144, and Bd. XXII. S. 69.

† Pogg. Ann., Bd. XCV. S. 204.

‡ Ibid., Bd. XCVIII. S. 293.

Secondly, these experiments were made with a native sulphide of antimony; their success depended upon its purity, and upon its having the precise atomic constitution attributed to it. On the first of these points we have the opinion of Berzelius, that "native compounds are never sufficiently pure to be used in such researches." † We know by the experience of Dumas, of Erdmann and Marchand, and of Scheerer in the determination of the atomic weights of calcium and magnesium, how difficult it is to detect and make allowance for the presence of minute quantities of foreign bodies; and every one who has worked with antimony will admit that the difficulty in this case is still greater. On the subject of the precise atomic constitution of these native compounds I have long had doubts; and the paper which I recently had the honor of submitting to the Academy shows that they may not be without foundation, even when the body can be obtained in well-defined crystals.

Whatever may be thought of these doubts, which it is indeed easy to raise about the best-executed work, the *fact* of the dependence of the atomic weight in Schneider's experiments upon the quantity of matter operated upon, seems to me sufficient to destroy confidence in his results. I have, accordingly, not calculated the probable error of his determinations; his extreme numbers are 120.08 and 120.53, the mean of eight being 120.3.

Professor Rose's work ‡ was published rather as a confirmation of the equivalent obtained by Schneider, than as an independent research upon the atomic weight. He gives as trustworthy the result of but one analysis of the chloride, and that not made by himself. From this he derived the number 120.7.

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* "Sans exception aucune, tout verre chauffé longtemps au rouge dans la flamme de l'alcool ou du gaz éclairant, diminue de poids lentement, mais constamment." — Recherches sur les Rapports Réciproques des Poids Atomiques, (Bruxelles, 1860,) p. 17.

† "Les composés naturels ne sont jamais assez purs pour être propres à des pareilles recherches." — Traité de Chimie, (Paris, 1847,) Tom. IV. p. 529.

‡ Pogg. Ann., Bd. XCVIII. S. 455.

Of the researches which place the atomic weight at about 122, my own [*] was the first in point of time, and was commenced before the publication of that of Schneider. After attempting without success to deduce the atomic weight from the quantity of gold which a known weight of antimony could precipitate, with the view of rendering as small as possible the influence of the errors of the operation upon the result, the determination was finally effected by oxidizing the pure metal by nitric acid, and ascertaining the weight of the resulting antimoniate of oxide of antimony. That this body has really the composition SbO_4 was also proved by a separate experiment. The process, besides its simplicity and accuracy, has the advantage of giving the atomic weight directly dependent upon that of oxygen. In ten determinations the equivalent was found from 122.24 to 122.48. The most probable value is 122.33; and the probable error of the individual determinations is 0.05.

In the last edition of the *Handwörterbuch der Chemie* [†] this determination is spoken of as being not so accurate (*weniger genau*), by which is probably meant that it is not so correct, as that of Schneider. As no reason whatever is given for this opinion, I do not think it calls for any other remark than that the writer, H. Bolley, apparently had not read the paper which he thus criticises. For in the very next article,[‡] by the same writer, the determination of chloride of antimony by means of the double chloride of gold and potassium is recommended; although this process had been thoroughly tried by me, in the hope of making it available in the determination of the atomic weight, and stated to lead to completely erroneous results. That this process had given Professor Rose apparently satisfactory results when the equivalent of antimony was taken at 129, would not *generally* be thought a good reason for supposing that it would give equally good ones when the equivalent was found to be only 120. In fact, Rose has since admitted in a similar case, and referring to my experiments, that the process must be abandoned.[§]

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[*] Pogg. Ann., Bd. C. S. 563.

[†] Braunschweig, 1858. Art. *Antimon.*, Bd. II. S. 43.

[‡] Art. *Antimon.*, *Bestimmung und Trennung*, S. 56.

[§] Pogg. Ann., Bd. CX. S. 541.

In another article of the same work, the objection is raised that "the antimoniate of oxide of antimony (SbO_4) always contains excess of oxide."* This is, so far as I know, mere assertion, utterly unsupported by facts. On the contrary, it is stated in another article of the same volume of the same work,† that the body in question is obtained in a state of purity by "ignition of nitrate of antimony or of antimonic acid"; that is, by the very operation by which it was obtained in the determination of the atomic weight. The origin of this assertion may, I think, be traced to a passage in Schneider's paper,‡ in which he says that "there is no proof that this substance (SbO_4) does not give off oxygen when strongly ignited"; and that to this cause may perhaps be ascribed the difference in the results of the earlier and the later determinations of Berzelius. But Schneider made no experiments himself to prove that it *does* give off oxygen, and it is not probable that, were this the case, the fact would have remained unobserved by Berzelius.§

Opposed to these unsupported assertions we have the general experience of chemists, and the high authority of Bunsen in particular, who declares that "the best way of determining antimony is as antimoniate of oxide of antimony, since this body is neither volatilized nor decomposed by ignition in contact with air." ‖ Finally, it was shown by me, by direct experiment, that the product of the action of nitric acid upon metallic antimony has, after having been ignited, the composition of antimoniate of oxide of antimony, viz. SbO_4 or Sb_2O_8. The difference between the composition calculated upon this formula and that actually found was such as to indicate an error in the analysis somewhat smaller than the probable error of the individual determinations of the atomic weight.*

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* "Doch scheint ein Ueberschuss von Antimonoxyd bei dem antimonsauren Antimonoxyd kaum zu vermeiden." — Art. *Atomgewichte*, S. 473.

† Art. *Antimonige Säure*, S. 78.

‡ *Loc. cit.*, S. 294.

§ The difference in his results was attributed by Berzelius himself to the fact that his earlier experiments were conducted in vessels of glass, which were incapable of supporting the temperature required for the complete conversion of SbO_3 into SbO_4.

‖ "Was zunächst die Bestimmung des Antimons anbelangt, so wägt man dasselbe am zweckmässigsten als antimonsaures Antimonoxyd, Sb_2O_8, indem diese Oxydationsstufe bei dem Glühen an der Luft weder flüchtig noch zersetzbar ist." — *Unterscheidung und Trennung des Arseniks vom Antimon und Zinn*, Ann. d. Chem. u. Phys., Bd. CVI. S. 3.

In the research of M. Dumas,† a known weight of chloride of antimony ($SbCl_3$) was dissolved in a solution of tartaric acid, and the quantity of silver required for the exact precipitation of the chlorine determined by volumetric process. Four determinations, said to have

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* Pogg. Ann., Bd. C. S. 577. An abstract of the memoir referred to is appended.

Determination of the Atomic Weight of Antimony. By W. P. Dexter.

(Translated and abridged from the original Memoir in Poggendorff's Annals.)

The antimony used in the following determinations was prepared by igniting commercial tartrate of antimony and potash, which had been previously purified by recrystallization, with an equal weight of nitre, adding to the mass after it had become perfectly white a quantity of hydrate of potash equal to half that of the nitre employed, and keeping the mixture in fusion at a dull red heat for about half an hour. The fused mass was then poured into a clean iron vessel: it dissolved easily and completely in hot water. The solution was filtered, and precipitated as metantimoniate of soda by a solution of common salt, from which the magnesia which it always contains had been separated by means of carbonate of soda. The metantimoniate of soda was washed first by decantation, and then upon a filter. It was then digested with nitric acid to remove the soda, and finally repeatedly washed, by decantation, with dilute nitric acid.

The hydrated antimonic acid was dried and reduced to the metallic state by ignition in a porcelain crucible thickly coated with charcoal. To make sure that the metal should take up no impurities from the charcoal, the latter was used in the state of lampblack, deposited by a lamp fed with oil of turpentine and burning under a large porcelain vessel filled with water. The coal thus obtained is absolutely free from all inorganic impurities, and burns without leaving the slightest trace of ash.

The antimony procured by this process contained sodium, reduced with it from some of the soda which had resisted the action of the nitric acid. It was finely powdered, mixed intimately with a fresh portion of antimonic acid, and again ignited in a porcelain crucible. The metal collected in a button at the bottom covered with a layer of fused oxide of antimony.

The atomic weight having been determined upon one portion of this antimony, the residue was again fused in the same way with more antimonic acid, and another determination made upon the product. The agreement of the two determinations showed that the sodium had been completely removed by the first fusion.

As it was possible that the metal might retain oxide of antimony in combination, a third determination was made upon a portion which had been kept in fusion for half an hour in a current of dry hydrogen. The result, however, was not sensibly altered by this treatment.

The determination of the atomic weight was effected by oxidizing the metal with nitric acid, and converting the residue, by ignition, into the compound of antimonic acid and oxide of antimony expressed by the formula SbO_4 or Sb_2O_8. This pro-

† Ann. Chim. Phys., 3^{me} Série, Tom. LV. p. 175.

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cess has the advantages of simplicity in execution, and of giving the atomic weight directly dependent upon that of oxygen; but in consequence of the high equivalent of antimony the result is very much affected by the unavoidable errors of the operation. This will appear when we consider that the atomic weight is connected with the observed values by the equation

$$Sb = \frac{32\,p}{q - p},$$

in which p denotes the weight of metallic antimony taken, q that of the SbO_4 obtained, and the atomic weight of hydrogen is taken as unity.

If we suppose that the whole error of the operation lay in the determination of q, and differentiate the above equation in respect to this value, we have

$$d\,Sb = -\frac{32\,p}{(q - p)^2}\,dq = -\frac{Sb^2}{32\,p}\,dq;$$

and putting for Sb the value deduced from the determinations, viz. 122.34, and for p the number belonging to any one of these determinations, for example 3, we find that

$$d\,Sb = -156\,dq;$$

or, that in this case a small error committed in the determination of q is multiplied about 156 times in its effect upon the atomic weight, and that this effect increases as the square of the atomic weight to be determined.

These considerations led to many trials of the possibility of deducing the atomic weight from the quantity of gold which a known quantity of antimony could precipitate from an acid solution of the double chloride of gold and potassium ($AuCl_3$, KCl). These attempts proved unsuccessful; the quantity of gold precipitated seemed to be dependent upon the amount of acid in the gold solution, being greatest when the solution contained the least free acid. They showed that this process, which has been recommended for the quantitative analysis of mixtures of SbO_5 and SbO_3 is entirely unreliable. It was noticed that a solution of $SbCl_3$ in hydrochloric acid which had been digested with metallic antimony until it no longer gave a blue color with starch and iodide of potassium, acquired this property after having been exposed for some hours to the action of the air. It would seem that absorption of oxygen takes place with formation of antimonic acid, or the corresponding perchloride of antimony. A similar absorption of oxygen by the salts of arsenious acid has been observed by Fresenius.*

The nitric acid employed for the oxidation of the antimony was most carefully prepared from distilled sulphuric acid, and the purest nitre of commerce from which every trace of chlorine was removed by means of nitrate of silver. It was still further purified by a second distillation from the same nitre, conducted at a temperature below the boiling-point of the acid, in order to prevent the possibility of any solid matter being carried over mechanically with the vapor. The acid thus ob-

* Ann. d. Ch. u. Pharm., Bd. XCIII. S. 384.

been made with pure material, gave the numbers 122, 122, 122.20, and 121.94. The most probable value is 122.07, and the probable

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tained was not perfectly pure, but left, when evaporated, a slight residue, probably arising from its action upon the glass of the retort. The amount of this residue was ascertained, and allowance made for it in the estimation of the weight of the SbO_4. The balance upon which the weighings were made was from Oertling in Berlin, and was used for no other purpose during the work. The weighings were always effected by placing a brass weight of 50 grammes in one pan, while the platinum crucible to be weighed was placed in the other, and brought into equilibrium with it by the addition of weights. The weights were made by Staudinger of Giessen expressly for this purpose; they were entirely of platinum, from 10 grammes downwards, and so accurately adjusted, that, although the balance indicated the 0.00005 of a gramme, not the slightest discrepancy could be observed in comparing different combinations of equal value.

To prevent loss by effervescence in the action of the acid, the platinum crucible was provided with an arrangement consisting of a perforated plate of platinum fitting the inside of the crucible, and having attached to it at some little distance a concentric disk of the same metal, and of greater diameter than the perforation in the plate.

The antimony was reduced to the finest powder in an agate mortar, and acted upon at first with a somewhat diluted acid, in order to prevent a too violent effervescence. But as the product then was chiefly nitrate of oxide of antimony, and it was possible, although not probable, that, if ignited in this state, a portion of the oxide might be volatilized, it was subsequently treated with concentrated acid, to convert it as fully as possible into antimonic acid, and evaporated in an air-bath to dryness.

To protect the contents of the crucible during the ignition from the reducing action of the flame, it was inserted in a hole in the centre of a plate of sheet-iron, a tightly fitting ring of platinum having been interposed between the crucible and the iron.* Of 14 determinations, 4 were rejected as unreliable; the results of the remaining 10 are exhibited in the following table.

		Sb taken.	SbO_4 obtained.	Atomic Weight (O = 100).	Atomic Weight (H = 1).
2	*a*	1.7638	2.2251	1529.4	122.352
3	*b*	1.5909	2.0069	1529.7	122.376
4	*a*	3.0640	3.8660	1528.2	122.256
5	*c*	3.2896	4.1501	1529.2	122.336
7	*d*	1.7488	2.2066	1528.0	122.240
8	*d*	1.5186	1.9157	1529.7	122.376
9	*d*	3.1330	3.9526	1529.0	122.320
12	*b*	1.50265	1.89585	1528.6	122.288
13	*a*	2.0759	2.61825	1531.0	122.48
14	*e*	1.7944	2.26355	1529.9	122.392

The letters *a*, *b*, *c* in the second column denote three different preparations of

* For a more detailed description of the apparatus I must refer to the original paper.

error of the individual observations is 0.1, or twice that of my own determinations. No account is given of the process by which the

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antimony; *d* was formed by a second fusion of *c* with antimonic acid; *e* by fusion in a current of hydrogen.

The probable value of the atomic weight deduced from the ten observations by the method of least squares is 1529.2 for $O = 100$, or 122.336 for $H = 1$; with a probable error, in the individual determinations, of 0.6 in the one case, and of 0.048 in the other. This error corresponds to an error in the operation somewhat less than 0.0003 gramme.

For the composition of the antimoniate of oxide of antimony the probable value is

Sb	79.266
4 O	20.734
	100.

It remains now to be shown, that in the antimoniate of oxide of antimony the antimony and oxigen exist in the exact proportion of 1 atom to 4, as has been assumed in the foregoing calculations.

This composition was inferred by Berzelius from his experiments upon the sulphide; it seemed to me desirable that it should be proved by direct examination of the oxides. For this purpose the oxide precipitated from chloride of antimony by carbonate of potash or soda, which always retains traces of the alkali, was placed in a small platinum boat in a combustion tube, and a stream of dry carbonic acid, generated in a self-regulating apparatus, led through the tube, till the air was completely expelled. The part of the tube in which the oxide lay being heated by a lamp-furnace, the oxide melted, and sublimed in beautiful and perfect crystals, shooting across and filling up the tube. 1.52045 gr. of these crystals, which were proved to be entirely free from any higher oxide of antimony, gave by oxidation with nitric acid 1.60385 gr. SbO_4: consequently 100 SbO_4 may be regarded as containing 94.8 SbO_3. We have before found that 100 SbO_4 contain 79.266 Sb; hence the relation of the oxygen of SbO_4 to that of SbO_3 is that of 100 — 79.266 to 94.8 — 79.266, or of 4.004 to 3.*

It may be stated, then, as the result of this work: —

1. That oxide of antimony cannot be determined quantitatively, as has been asserted, by means of the double chloride of gold and potassium.

2. That solution of chloride of antimony, after having been exposed to the action of the air, will be found to contain a higher degree of oxidation of the metal.

3. That the relation of the oxygen in the oxide, and in the antimoniate of the oxide of antimony, as shown by direct analysis of these oxides, is that of 3 : 4; as has been hitherto assumed.

4. That the probable value of the atomic weight deduced from ten observations is 122.34; the atomic weight of hydrogen being taken as unity.

* If, conversely, the above experiment be used for the determination of the atomic weight, it gives the number 121.84. But it is evidently unsuited to secure any degeee of accuracy; for we have only to admit an error in the operation of 0.00025, that is, less than the probable error of the former observations, to derive from it the same number, 122.34.

chloride was obtained, except that it was prepared with "very pure antimony and dry chlorine, and distilled several times over finely powdered antimony." We have, consequently, no guaranty for its purity beyond the assertion of the author. But this is a point upon which we are entitled to demand the most precise information in a work which claims not only to be an exact determination of a chemical constant, but also to decide the question whether the equivalents are or are not multiples of that of hydrogen. It is well known that upon this very point, the purity of the antimony obtained by a certain process, there was for a long time a disagreement between chemists as eminent as Berzelius and Liebig; and that it was finally conceded that the metal so prepared does contain an appreciable quantity of arsenic. Now what proof have we that the antimony used in these determinations may not have been prepared by the process of Liebig? and that the trifling differences in the results of M. Dumas and myself may not have been caused by the presence of a minute quantity of arsenic, a substance difficult of detection when mingled with a large amount of antimony, and whose atomic weight is lower than that of antimony in the proportion nearly of 3 to 5? If it be considered unfair to M. Dumas to assume that his material was impure, it is certainly fair to demand that he should give the proof that it was not.

The properties of the chloride of antimony, also, are such as to render extreme accuracy difficult of attainment. A body which attracts moisture with the utmost avidity, and which, if every trace of moisture be not excluded, gives on distillation a product containing free hydrochloric acid, is not one which would willingly be selected for the purpose of a normal determination. M. Dumas says that he tried without success to effect the determination by the reduction of the oxide and of the sulphide, and by oxidation of the metal with nitric acid.*

But the last-named process gave Berzelius agreeing results, and I have shown that the accuracy of those obtained by myself in the same way is about twice that of the determinations made upon the chloride. It is not easy to believe that a process which has succeeded in the hands of others would offer any difficulty to so consummate a manipulator as M. Dumas.

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* "J'ai essayé sans succès de déterminer l'équivalent soit en réduisant les fleurs argentines d'antimoine, soit en réduisant le sulfure d'antimoine, soit en acidifiant l'antimoine par l'acide nitrique. Je n'ai obtenu par ces divers procédés que des résultats très-discordants."

An experiment of Mulder[*] deserves notice here, as showing the possible existence of a cause of error in the processes made use of both by Rose and Dumas. Mulder dissolved 1 gramme of silver and 0.13 gr. of antimony in nitric acid, added 5 gr. of tartaric acid to retain the antimony in solution, and then determined the silver by precipitation with a standard solution of salt. He obtained 999.125 instead of 1,000, while a similar experiment without the antimony and tartaric acid gave precisely 1,000 silver. Upon what this difference of nearly 0.9 milligr. depended was not ascertained. It is not impossible that a trace of tartrate of silver may be precipitated with the chloride; and if this be so, the chlorine would be estimated too high, whether determined volumetrically, as in the case of Dumas, or by weight, as was done by Rose; and the atomic weight would consequently be found too low.

It appears from the foregoing remarks that recent investigations may be considered as having led essentially to two different numbers for the atomic weight of antimony. That of these numbers, the one, 120, was first deduced by Schneider, and is supported by a single analysis of Professor Rose. That the other, 122.34 is the result of my own observations, subsequently confirmed by the works of Dumas and of Kessler, of which the first differs only by a few decimals from, and the second agrees precisely with, the equivalent previously obtained by me. I have given the reasons which cause me to doubt the correctness of the equivalent assigned by Schneider; I cannot think that three experimenters, working independently of each other and using different processes, would arrive at results so nearly identical, were these results very far removed from the truth.

Five hundred and third meeting.

January 29, 1862. — STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter of acknowledgment from the Corporation of Brown University for a copy of the Memoirs of the Academy, Vol. VIII. Part I.

Dr. John Dean, of Boston, was elected a Fellow, in Class II. Section 2.

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[*] Die Silber-Probirmethode, von G. J. Mulder, (Leipzig, 1859,) S. 165.

Alvan Clark, Esq., of Cambridge, in Class I. Section 2.

Right Rev. John B. Fitzpatrick, of Boston, in Class III. Section 4.

Sir William Fairbairn, of Manchester, England, was chosen a Foreign Honorary Member, in Class I. Section 4, in place of the late Robert Stephenson.

Prof. Treadwell, in a communication upon improvements in heavy ordnance, took occasion to criticise a recent work upon this subject by Captain Rodman, U. S. A.

The work in question is contained in a series of Reports made by Captain Rodman, of his experiments, performed, through a number of years, and at a very great expense to the government, and now printed in a very costly form, but not published, in the usual sense of that word. The experiments had for their ultimate object the improvement of cast-iron ordnance, and more especially to prove the value of a method, devised by Captain Rodman, of cooling the gun from its fluid state. To accomplish this, he restores the old method of casting the gun upon a core, and passes through the axis of this core a stream of cold water. The purpose of this is to produce a more perfect equilibrium of the particles of iron than they possess when the cooling is performed from the outside surface, as is the case when guns are cast solid. This seems to be a good method for casting large guns, and the few experiments that have been made upon proving, to extremity, guns cast in this way, show in its favor. He produces, after all, but a cast-iron gun, and the labors of others, upon other materials, have established the fact that cast-iron guns and round shot are soon to give place to another generation, formed of a different material and upon an entirely different plan. But of this I shall speak hereafter.

The first question now is, whether Captain Rodman's experiments, and the deductions drawn from them, are trustworthy. Now, the whole superstructure which he lays out, and proposes to raise, depends upon an instrument which he has constructed for determining, as he supposes, the actual force of the fluid produced by fired gunpowder under almost all possible circumstances, and the power of cast-iron guns to resist the force thus created without being destroyed by it. This instrument is at once the compass, quadrant, and chronometer by which he is guided in his voyage of discovery. It is described particularly at pages 174 and 175, with a good plate annexed. Plates of it are given likewise, in some modified form, in several other places.

This instrument and its use will be understood by any engineer or intelligent mechanic from the following description. Suppose a row of six small holes to be drilled through the side of a cannon, into its caliber. These holes are placed 14 inches apart, and, commencing near the breech, extend to near the muzzle, or a distance of 84 inches. The instrument consists of a small but strong iron frame, having a shank or plug forged upon one of its sides. This plug is 1½ inches in diameter and 1½ inches long, and is formed into a screw, the thread of which corresponds with a similar screw-thread cut into the outer portion of each of the holes in the side of the gun, by which means the frame may be secured to either of the holes, at pleasure. A small hole is bored through the axis of this plug, making a free passage to the caliber of the gun. A piston is nicely fitted to this hole in the plug, and thus the end of the piston receiving the whole force of the fired gunpowder will be driven outwards at each discharge. A large steel head or block is fitted upon the outer end of the piston, and from this head rises a pyramidal or lozenge-shaped point, or blunt edge. Against this edge, and firmly fixed in the frame, is a piece of thick copper. Now when the gun is fired, the piston, being driven outwards, forces this dull point or edge into the copper, and leaves a mark or impression upon it corresponding in depth to the force with which the piston was driven against it. By comparing an impression, made in this way, with another impression made upon another piece of copper by the actual pressure of weights placed upon a similar tool, Captain Rodman supposes that the force of the piston may be estimated very nearly. It will be seen, on proceeding a little further, that the force of the point, by which the impression is made by the instrument, is not the equivalent of the pressure upon the caliber of the gun, and that it was a gross oversight in Captain Rodman to consider them as equals. It will, of course, be understood, that, when one of the holes is used by the instrument, the others are closed by screw-plugs made to fit them.

Let us, then, see whether the instrument will perform what is claimed for it. First, then, it is said that the indentation or impression made by the blunt or diamond-shaped point indicates the *pressure* of the fired gunpowder; that it acts by *pressure* purely, as a heavy weight acts when placed slowly upon a support, and not by a blow, as the same weight will act when suffered to fall through some sensible space, and certain facts are adduced at page 178 to sustain this view. I shall not stop here to show the fallacies of these supposed analogies, but appeal first to the direct teaching of a simple experiment. Take, then, a little spring balance, such as is used at some of the post-offices for weighing letters, and which consists of a little pedestal and column, like a candlestick, which contains a spiral spring, and over the top is the pan, to hold the thing to be weighed. Now take any weight that will carry the pan just down to the top of the column when slowly applied. Half of this weight will carry the pan half-way down, if applied in the same way, but if you add to this half weight a small quantity, just enough to overcome the friction of the acting parts, and hold this upon the pan when at its full height, so as just to touch its surface, and then release it *suddenly*, the pan will descend to the top of the socket, or will mark twice the weight that it actually possesses. The cause of this must be so apparent to any one well acquainted with the laws of moving forces that I shall not stop to explain it here. Yet the action of the weight here is perfectly analogous to the action of Captain Rodman's instrument, or that part of it which is moved by the powder to make the impression, namely, the indenting tool, the block upon which it rests, and the little piston which receives the force of the powder. The mass of matter of which these are constituted is *fired* against, or into, the copper, as much as the ball is fired out of the muzzle of the gun. The analogy with the experiment of the spring balance is this: the indenting tool and its appendages are pressed forward by the gunpowder. The weight upon the spring balance is pressed down by gravitation. These pressures change the inertia in both cases into living force. This living force accumulates during the motion, from the gravitation in the weight, and the powder pressure in the gun, being, through the first half of the space, twice as great as the mean force of the resistance of the spring in the one case, and the copper in the other; and this accumulation is displayed in overcoming the resistance during a space equal to that first passed over.

We see, then, from the analogy of the weight falling upon a spring balance, that Captain Rodman's instrument ought to display and register double the force which he applies to it; even if it acts as freely and undisturbedly as a spring balance, it cannot make less than a double register. But we shall see by and by that this is but a small part of the actual error; and yet Captain Rodman takes its register as true to within 1,000 pounds in cases, which he supposes to have been of pressure, of 90,000 or 100,000 pounds. He seems, indeed, to have had no suspicion of any error when his instrument gave indications of force wholly incompatible with the strength of the materials to which it was applied. Thus, at page 197, he takes the force which acted upon it at 100,000 to the square inch. Now the instrument in this case was held to the gun by a screw, formed into the cast-iron body of the gun, 1½ inches in diameter and 1½ inches deep. This gives an area of the *plug* of the instrument of 1.75 square inches, which received the full pressure of the fired powder. The pressure upon the end of the instrument then was 1.75 × 100,000 = 175,000 pounds, or about 80 tons. He must be a very bold engineer who would sleep under a weight of 10 tons suspended over him by a bolt tapped into a hole, in a cast-iron plate of 1½ inches in diameter and 1½ inches deep; and yet it does not seem to have occurred to Captain Rodman that 80 tons' pressure must have driven his instrument from its place.

But let us go a step further. Captain Rodman, at page 192 *et seq.*, relates a course of experiments which may be given in short hand as follows. He made 18 cylinders, of three different kinds of iron. They were all one foot long, and all bored out through their entire lengths with calibers two inches in diameter. They were then turned off on their outsides, so as to leave them of six different thicknesses, varying from each other from half an inch up to three inches; the variation being, of course, by increments of half an inch. Each kind of iron gave one cylinder of each thickness. The mean strength of the iron, as ascertained from specimens of each casting, being 26.866, say 27,000 pounds per square inch. These cylinders were then subjected to a bursting force produced by firing gunpowder confined within them. This was done for the purpose of ascertaining the power of cast-iron of these different thicknesses to withstand the force thus produced. The force was measured, by Captain Rodman's instrument, of course, and the first two columns in the following table give the strength of each thickness of metal according to Captain Rodman's mean: —

½	37842	25541
1	38313	38313
1½	63384	46057
2	80229	51085
2½	92270	54732
3	93702	57468

Upon seeing the enormous strength thus given to the iron, Captain Rodman merely remarks that the bursting pressures are greater in the whole series than required by the tenacity of the iron, "even supposing the whole thickness of metal to resist uniformly as in tensile strain." But no doubt seems to cross his mind as to the accuracy of his instrument or his measures; he therefore proceeds forthwith to compute the force on the hypothesis "that the strain diminishes as the square of the distance from the axis increases." This means to reduce the power of the metal to sustain pressure, at different thicknesses, according to Barlow's formula. I have given his numbers in the third column above.

I confess I was puzzled for a long time to find out what these numbers meant. The tenacity of the iron used was 27,000 pounds to the inch; Barlow's formula gives for a cylinder 2 inches in internal diameter and 1 inch thick, made of such iron, just half of this tenacity, or 13,500 pounds. I then went over all the different thicknesses according to Barlow's formula, and found even stronger cases of discrepancy than that here cited; and as I do not profess to be a mathematician of a very high order, while Captain Rodman has the calculus "familiar as his garter," I thought it was possible, after all, that I had misunderstood Barlow's rule. I therefore laid down, in section, each of the cylinders in full size, and requested three of the distinguished mathematicians of Cambridge to tell me what must be the strength of each according to Barlow's rule. They all calculated separately, and all agreed with each other and with me exactly, and I here give the whole matter in a tabular form.

1st column in this table, gives the thickness of the several cylinders.

2d column, the pressure per square inch, as measured by Captain Rodman's instrument, under which each cylinder burst.

3d. The pressure which the cylinders ought to have sustained according to Captain Rodman's computations, from Barlow's formula.

4th. The true pressure of burstings according to Barlow's *formula* as computed and applied by me, on iron having 27,000 pounds per inch tenacity, — this being the mean tenacity of these specimens, as stated on p. 192.

5th. The errors of Captain Rodman's experiments, or of his instrument.

6th. The errors of Captain Rodman's computations.

1	2	3	4	5	6
½	37842	25541	9000	28842	16541
1	38313	38313	13500	24813	24813
1½	63384	46057	16200	47184	29857
2	80229	51085	18000	62229	33085
2½	92270	54732	19286	72984	35446
3	93702	57468	20250	73452	37218

[NOTE. — The reader is requested to attend particularly to the 5th and 6th columns of this table, as these give the errors of the instrument, and of the computations.]

Now how is all this? Why, Captain Rodman in his computations took, not the coefficient of the true tenacity of 27,000, as laid down by Barlow, but the tenacity which his instrument gave for the cylinder one inch thick. Thus taking at 38,313 what should have been 13,500. Not only so, but the law of the inverse square, which he used, and which is Barlow's rule, makes it impossible that any of his last instrumental measures should be nearly right, even if the tenacity be increased from 27,000 up to 76,626, which is the number that he in fact uses. For, according to this law, a cylinder of two inches' internal diameter, made of cast-iron, or any *unmalleable* material, of 76,626 pounds' tenacity, can never be made thick enough to sustain a pressure of 76,626, or at least it cannot be done until some one shall contrive to make $1 \times x = 1 + x$, or 1 multiplied by 1 equal to 1 added to 1, a feat which Captain Rodman's instrument must have performed in giving several of the results above tabulated.

I do not think it will be necessary to pursue this instrument any further to show its utter worthlessness. It must be given up, and the whole family of results born of it must go with it.*

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* I shall be excused for citing one other case, although it may be thought, by some, unnecessary. Captain Rodman gives, at page 197, in his table, the force produced by firing 12.67 pounds of powder in an 11-inch gun, behind a shot of 186.4 pounds' weight, at, in one instance, 100,000 pounds. Now this must have given a *bursting* pressure upon the walls of the gun of 1,100,000 pounds to every inch of its length; consequently, if the gun was 11 inches thick, the iron to sustain this pressure must, if Barlow's formula be true, (and Captain Rodman makes no

I shall pass, therefore, from Captain Rodman's instrument to an examination of his gunpowder. When the newspapers, some time ago, gave the story of Captain Rodman's experiments with his 15-inch gun, there was a great account made of the strange kind of gunpowder used, the grains of which were said to be as big as pigeons' eggs. But Captain Rodman's book gives us the reason for the use of this very coarse powder. It is to avoid the great stress laid upon the gun by the rapid development of the gas or fluid, as produced by powder of common grain, from its quick combustion. Now, Captain Rodman proposes, by the slow combustion of these large lumps, not only to avoid the shock of the first explosion, but to continue the development of the force through the whole length of the bore. This would certainly make it much easier work for the breech portion of the gun; but the fact of resorting to it shows the suspicion entertained by Captain Rodman of his gun's strength.

Let us, then, first see how far the idea of equalizing the pressure is obtained by increasing the size of the grain. To do this, I must resort to the measures given by Captain Rodman's instrument, which, though worthless as absolute measures, may yet give some rude approximation to comparative values when used upon the same gun and upon the same place, but with different grained powders. Turning to his book, then (p. 203), we find that a charge of 8 lbs. of powder grained to .1 of an inch diameter, gave against a 43-lb. shot a force of 51,800 lbs., 14 inches from the breech, and 6,700 lbs. at the distance of 84 inches, — these being the greatest and least forces; while a charge of 8 lbs. of powder of .4 inch grain, or 64 times the former in size of grain, gave against the same shot 31,950 lbs. for the greatest, and 5,150 lbs. for its least force. The greatest force of the fine powder, then, was about 7 times that of the least force; while the greatest force of the coarse powder was about 6 times that of the least force. Surely this is no

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doubt of that, but uses it, under the name of the inverse square,) have possessed a tenacity of 150,000 pounds to the inch. Not only will no cast-iron bear this strain, but no metal, nor any other substance whatever yet known to the art of man, is capable of bearing it. Even cast-steel, the strongest body known, when wrought down by the best hammering, will not sustain 150,000 pounds to the inch. Indeed, if a mass of iron gun-metal, though the strongest ever made, were cast as large as the Capitol at Washington, and then bored through with a caliber of 11 inches, it would, according to Barlow's formula, be split by a fluid pressure of, not 150,000, but 50,000 pounds to the inch.

great advance in equalizing the forces between the breech and the muzzle of the gun. But let us see what it costs in loss of force from the use of the coarse powder. Taking the mean of these two extremes as the true force in both cases, we have 51,800 + 6,700 ÷ 2 = 29,250 for the mean force of the 8 lbs. of fine powder, and 31,950 + 5,150 ÷ 2 = 18,550 for the mean force of the large powder; from which it will be seen that it will require 12½ lbs. of the coarse powder to produce the same force upon the shot that is produced by 8 lbs. of fine powder. The long and short of this whole matter of using the powder in lumps rather than grains is a *mechanical adulteration*, and produces the same effect, namely, a slow combustion, such as may be produced by making the powder of materials *chemically adulterated*, or by mixing a portion of clay with the paste, or by moistening good powder before using it. This reduction of force may be carried to any extent by increasing the size of the grains or lumps, or by making it in *perforated* cakes, as Captain Rodman actually proposes to do.

But suppose that Captain Rodman's ideas of the advantage of a slow development of the force could be carried out, of what use would it be? I assert, although I am not yet quite prepared with a formal demonstration of it, that the same, or very nearly the same, quantity of iron will be required in the gun, the iron being used in the manner pointed out by me in 1855, to give the same velocity to a given shot, under whatever law the force is developed, between the limits of the quickest powder now used, and one of equable force development; and that, to produce this force with the least expenditure of powder, the development of the force should be made as quick as possible.

I now pass to an examination of Captain Rodman's proposal to use hollow shot. Having, as it seems to me, laid his powder under as great a contribution as it would bear, to avoid putting too much stress upon his gun, he proceeds to put the same tax upon his shot, and he assesses it by taking 9 inches from the heart of every 15-inch shot, thus reducing its weight from about 425 pounds to about 320 pounds. In the mediæval times, when guns and gunnery were in their infancy, stone balls were used. The lightness of this material saved the imperfect *bombards* from destruction. The effect of these balls was of course very small, compared with the heavy, solid iron shot brought into use in a later age. Are we to return to the mediæval practice? This certainly seems a step in that direction.

Sir Howard Douglass, in speaking of the terrible effect of the fire of the American frigates in the war of 1812, says that some of them used shot weighted by a leaden core. This I believe is not true, but it shows the opinion of this old engineer, of the advantage that might be expected from increasing rather than diminishing the specific gravity of cannon-shot. Yet Captain Rodman's hollow shot seems to be looked to (pp. 289, 307) as the missile to meet iron-plated ships. Whether it is intended to explode them against the ship, or to depend upon their direct percussion, is not very clearly stated. The effect would probably be very much alike in both cases. Indeed, Captain Rodman admits (p. 298), that, although "none of these broke in the gun, some did break in the sand-bank after the sand had been packed hard by repeated firing." God forbid, then, that we should ever have to try them against the sides of the Gloire or the Warrior.

I have thus examined some of the prominent points in the labors of Captain Rodman, as they are detailed in his reports; and, without, as I hope, making any remark disrespectful to him as an officer and gentleman, I have declared freely what seems to me the value of the most important of the experiments and conclusions given in his work. Repeating here what I declared in an earlier part of this paper, that I think well of his method of cooling the hollow casting which is to form a gun, I think that there is good reason to believe that these guns will be somewhat superior to those made in the usual method. In the practice of casting in this way, however, great care must be observed to avoid the explosion which may occur should the cooling water find its way from its conductor into the body of the mould.

Five hundred and fourth meeting.

February 11, 1862. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters of acceptance from the Right Rev. Bishop Fitzpatrick and Dr. John Dean, recently elected Fellows, and from John M. Ordway, elected Associate Fellow of the Academy.

Professor Peirce, from the Committee to which the subject was referred, made a report upon the work of Capt. Humphreys and Lieut. Abbot, U. S. Topographical Engineers, upon the Mississippi River and the best mode of protecting its banks from overflow, — highly complimentary to the scientific character of their investigations. Professor Peirce proposed to offer a future and more detailed report, in conjunction with Mr. Runkle, who, upon his suggestion, was added to the Committee.

Professor Peirce made a second communication

Upon the System of Saturn.

The especial subject of this communication was, "The consideration of the subdivision of the ring into numerous small solid rings, and of the invalidity of the argument derived from statical conditions which has been urged against this subdivision." The investigation was conducted by the aid of completely integrated formulæ, which were obtained after much labor. The formulæ were embarrassed by terms which were subject to a reversal of sign when in a finite state, which can never happen in physical phenomena of this kind; but the embarrassment disappeared when it was observed that there were two different terms subject to the same paradoxical change of sign, and which were mutually antagonistic. From an exact numerical computation, it appears that, without violating the condition of statical equilibrium proposed in Mr. Bond's original memoir, Saturn's ring can be subdivided into about thirty-six rings of 600 miles of average breadth, with intervals of 150 miles between them. The inner and outer rings must be the broadest of all, and have a breadth of 800 or 1,000 miles, while the smallest of the intermediate rings will only have a breadth of 350 miles. It is curious that, with regard to the inner and outer rings, the attraction of each of these rings upon the surface which is towards the main body of the ring — that is, of the inner ring upon its outer edge, and of the outer ring upon its inner edge — is overbalanced by the attraction of the rest of the ring. Each of these portions of these rings, therefore, depends upon the combined action of Saturn and of its own centrifugal force to resist the destructive tendency of this external attraction. They have, therefore, each of them a time of revolution about Saturn, which properly belongs to no point of their mass, but to points of the general ring, intermediate between them.

The possibility of thus subdividing the ring into smaller ones without violating the statical condition proposed by Mr. Bond, proves that his argument was insufficient to demonstrate that the ring was not solid

In consequence of observations from Mr. Bond, Professor Peirce remarked that, as long as Saturn has a ring, the natural hypothesis of its solidity cannot be set aside from any argument of mere improbability, without the suggestion of some more probable hypothesis. The argument from uncomputed perturbation is especially vague and uncertain, and cannot be admitted into science, which is knowledge, and not ignorance. The hypothesis of a fluid ring was at the time of Mr. Bond's memoir more improbable than that of the subdivision into solids. For the mutual resistance of the particles of the ring to internal currents would sooner or later reduce the ring to one uniform velocity of revolution about Saturn, which would at once be its complete destruction, just as certainly as if it were solid. The fluid constitution is therefore quite impossible without some kind of action to counteract this tendency to break to pieces; and no such action was ever suggested or known to science until Mr. Peirce's own investigations upon the tidal action of the satellites.

Professor Peirce offered some remarks on Captain Rodman's work and experiments upon the construction of heavy ordnance. He regarded this work as of great scientific and practical value, and the observations as entitled to the highest confidence, on account of the accuracy and fidelity with which they are made. He found no corrections in the reductions of the observations which materially impair their value for the use for which they were made.

Five hundred and fifth meeting.

March 10, 1862. — ADJOURNED STATUTE MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters from Sir William Fairbairn and from Captain Duperrey, in acknowledgment of the official notification that they had been elected Foreign Honorary Members of the Academy. Also from Alvan Clark, Esq., of Cambridge, in acknowledgment of his election as a Fellow of the Academy.

Rev. James Mills Peirce, of Cambridge, was elected a Fellow, in Class I. Section 1.

Professor Agassiz made a communication upon the copulation of the Selachian Fishes.

Prof. Treadwell read an elaborate paper on the force of fired gunpowder, the strength of guns, and the velocity of projectiles; being a continuation of the examination made by him, at the January meeting, of Captain Rodman's instruments and experiments.

The examination of the subject this evening was made in special reference to the partial and conditional defence made by Professor Peirce, at the February meeting, of the accuracy of the instruments and experiments of Captain Rodman. Professor Treadwell explained the action of gunpowder, by referring it to the measure of the force of a column of liquid by which a jet is projected through an aperture in the side of a vessel. He then exhibited diagrams showing the force of powder in a cannon, during its development and action upon the ball; and, taking a particular case given in Captain Rodman's book, page 197, he showed that the measures of the force, as there given, were impossible, both in character and amount, as the ordinates representing the forces through the caliber are actually greater near the muzzle than nearer the breech. He then deduced, from the mean of all the ordinates, that the force produced by 12.67 pounds of powder must, if true, in this case have given a velocity of 2,966 feet a second to a ball of 186.3 pounds weight; when it is shown by the experiments of Captain Mordecai that a charge of 12 pounds will produce only a velocity of 2,046 feet a second in a 24-pound shot. He showed, moreover, that in this very experiment of Captain Rodman, where, if the instrumental measures of the force had been correct, the resulting velocity must have been 2,966 feet, the velocity actually produced was, as measured by Captain Rodman himself, only 920 feet a second. He then proceeded to demonstrate from all the preceding examination, that the actual mean pressure of the powder was but 3,390 pounds per square inch; whereas it is indicated by Captain Rodman's instrument at 35,213 pounds per inch; and hence that the instrumental measure is 10.38 times greater than the true measure.

Five hundred and sixth meeting.

April 8, 1862. — MONTHLY MEETING.

The PRESIDENT in the chair.

The Corresponding Secretary read letters relative to the exchanges of the Academy. Also a letter from the Rev. James M. Peirce, of Cambridge, in acknowledgment of his election as a Fellow.

Professor Rogers exhibited Plateau's experiments on thin viscid films and bubbles, with some original ones.

Professor Lovering, in behalf of the majority of the Rumford Committee, presented the following Report.

The Rumford Committee, having examined the subject of Hot-air Engines, and the recent improvements in their construction made in America, ask leave to report as follows: —

The Rumford Committee does not recommend that the Academy should award the Rumford Premium for the alleged recent improvements of Mr. Ericsson in the Hot-air Engine, nor for his engine as at present constructed.

MORRILL WYMAN,
JOSEPH LOVERING,
JOSEPH WINLOCK.

CAMBRIDGE, April 8, 1862.

Professor Horsford presented the following Report from the minority of the Committee.

The minority of the Rumford Committee report: —

That they dissent from the opinion of the majority, in that they believe the improvements in the caloric engine of Mr. Ericsson, which he brought out in 1858, are such as to entitle him to the Rumford Medal.

They see in them evidences of high inventive talent, of patient thought and prolonged and persevering experimental research, in the practical solution, on a large scale, of the various problems underlying the hot-air engine; — especially in the compact arrangement of the supply and working pistons, the telescopic tube, the fire-pot, and the regenerator in a single cylinder, thereby economizing heat and space; in the device for protecting the lubricating material of the packing of the working piston, by exposing it at each stroke to the current of entering cold air; and in the system of cranks, rockshafts, levers, and their connecting-rods, by which the varied, complicated, but necessary motions of the supply and working pistons are regulated and connected with each other and the fly-wheel.

The minority recommend that the Rumford Medal be awarded to Mr. Ericsson for his improvements in the management of heat, particularly as shown in his air engine of 1858.

E. N. HORSFORD,
CAMBRIDGE, April 8, 1862. DANIEL TREADWELL.

The two Reports being accepted, the subject was discussed in detail by Professors Horsford, Lovering, Winlock, Peirce, and Treadwell.

And, on motion of Professor Horsford, an adjourned meeting was voted to be held on the 22d instant, for the further consideration of the subject.

Five hundred and seventh meeting.

April 22, 1862. — ADJOURNED MONTHLY MEETING.

The VICE-PRESIDENT in the chair.

The Corresponding Secretary read a letter from Professor Trendelenburg, of Berlin, in acknowledgment of the notification of his election as a Foreign Honorary Member of the Academy.

He presented, from the author, a paper entitled *Plantæ Wrightianæ e Cuba Orientali, a* A. GRISEBACH: Pars II.

Also the following communication from Professor Tuckerman.

Observations on North American and other Lichenes. By EDWARD TUCKERMAN, A. M. (Continued from Vol. IV. p. 407.)

OMPHALARIA LEPTOPHYLLA, sp. nov.: thallo membranaceo-cartilagineo glabro atroviridi subtus subconcolore e centro in lobos undulatos apice latiori rotundatos repandos mox sinuato-lobatos diviso;

apotheciis minutis submarginalibus innato-prominulis demum pallidis tuberculiformibus disco punctiformi impresso. Sporæ in thecis elongato-clavatis octonæ, ellipsoideæ vel demum oblongo-ellipsoideæ, incolores, simplices, protoplasmate in guttulas (1 – 2) secedente diam. 1½ – 2½-plo longiores. "On rocks in rivulets, overflowed after rains," in the island of Cuba, *Mr. Wright*. Thallus rather thin, but firm, smooth, blackish-green or nearly black, (the largest specimens, perhaps, an inch in their longest diameter,) dividing at the centre into wavy lobes, with wider, rounded, repand tips, and becoming more or less sinuate-lobate, with often a plume-like aspect; or, less regularly, passing into narrower divisions. Gonimous granules of scarcely middling size, subsolitary, the filamentous elements amongst which they are interspersed being exceedingly delicate. Apothecia minute, superficial, becoming at length a little paler than the fronds, disposed in necklace-like chains, or sometimes in heaps, at or near the margin of the lobes, tuberculiform, and the disk punctiform-impressed, or more rarely at length flattened and sublecanorine. Spores in eights, in long-club-shaped spore-sacks, colorless, ellipsoid, or at length oblong-ellipsoid, simple; the protoplasm dissolving more or less into roundish drops; once and a half to twice and a half longer than wide. Paraphyses distinct, filiform. The subsolitary gonimous granules and more delicate filamentous elements separate this plant, as does also the thinner and more divided thallus, from *Omphalaria Girardi*, DR. & M., the type of the genus, both with Montagne and Nylander; but I know of no lichen with which I should sooner compare it. *O. Girardi* is, however, only known to me in infertile specimens (determined by Dr. Nylander, Syn., p. 99) which were detected by T. M. Peters, Esq., in Alabama. *Collema laciniatum*, Nyl. l. c. p. 116, which accompanies the Alabama lichen, grows intertangled with the present in Cuba. The apothecia of the present are at length rather prominent, for the most part perithecii-form; but they assume at length, in the oldest condition, a more regular and sublecanorine aspect.

Omphalaria lingulata, sp. nov.: thallo subcartilagineo viridi-fuscescente (fusco-nigrescente) e basi umbilicato-affixo in lobos spathulato-oblongos subsimplices plano-convexos subtus obscuriores diviso; apotheciis sparsis minutis crinatis pallidis disco impresso margine integro subprominulo demum cincto. Sporæ octonæ in thecis clavatis, incolores, oblongo-ellipsoideæ, simplices, protoplasmate granulosa vel guttulosa diam. 2–3-plo longiores. On rocks, "Farallones la Cavalina

(M. Revel, near Sagra)," in the island of Cuba, *Mr. Wright.* Thallus rather thinnish, but cartilagineous, fragile, of a brownish-green becoming at length blackish-brown color above, and mostly, or at length, darker below, dividing at the umbilicate base into oblong, spatulate, or tongue-shaped lobes, which are commonly subsimple, but occur also irregularly, and similarly but sparingly lobulate; slightly convex above, and margined for the most part, but scarcely canaliculate, below. Gonimous granules glomerulate, interspersed among anastomosing filamentous elements. Apothecia minute, scattered, innate, pale; the small impressed disk bordered by an at length slightly prominent and entire thalline margin. Spores in eights, in club-shaped spore-sacks, colorless, oblong-ellipsoid, simple; the protoplasm becoming guttulose or granulose; twice to thrice longer than wide. The apothecia resemble the smaller ones of *Collema pustulatum*, Ach. (nor does it appear otherwise than likely that the commonly verrucarioid apothecia of the last species express anything else than the lecanorine type, in a state the perfect development of which is for the most part precluded), and are sprinkled pretty thick over the thallus, much as in that species; but the gonidia are not concatenate, but glomerulate in the present, which is also affixed at a single point at the base, as in *Omphalaria*. The dimensions of the lichen vary from half to three quarters of an inch in the longest diameter, but single lobes occur among the specimens, which are much broken, of the same length.

Collema coccophorum, sp. nov.: thallo minuto orbiculari crasso nigro lobis periphericis expansis crenato-incisis centralibus adscendentibus granulato-lobulatis; apotheciis majusculis subplanis disco rufo-fusco margine thallino tenui cincto. Sporæ octonæ, incolores, ellipsoideæ l. ovoideo-ellipsoideæ, diblastæ 1½–2½-plo diametro longiores. On sandy earth in the valley of the Rio Grande, Texas, *Mr. Wright.* Small, roundish fronds, the largest of which a little exceed an inch through, of very small, thickish, black lobes, which are radiose-expanded, and crenate-cut, at the circumference, with mostly raised, at length granulate margins; and becoming towards the centre densely lobulate-granulate (with the aspect of a crust of black granules). Gonimous granules concatenate, amongst anastomosing filaments. Apothecia largish (often a line and a half through), flattish or plano-convex, the dark-reddish-brown disk enclosed by a thin, at length uneven and even granulate thalline margin. Spores colorless, ellipsoid and ovoid-ellipsoid, simple, or at length diblastish, once and a half to twice and a half longer than wide. This little species, of which abundant specimens were collected by Mr. Wright, is comparable with small states of *C. cheileum* (as Moug. & Nestl., n. 1056); but is more minute, with a different habit of thallus, and spores which appear never to be more than diblastish. The latter feature, if constant, separates it also from other allied species.

COLLEMA CALLIBOTRYS, sp. nov.: thallo mediocri suborbiculari membranaceo-cartilagineo rigidulo glauco-virescente lobis radiose expansis mox angustatis costatis lobulis adscendentibus capituliformi-dilatatis vel botryoso-difformibus apotheciis confertissimis mox coopertis; apotheciis minutis disco concavo-plano rubello excipulo thallino integerrimo fuscescenti-pallido recepto. Sporæ octonæ in thecis subcylindraceis, incolores, primo subquadratæ, sporoblastis 4 cruciatim dispositis dein longiores, ellipsoideæ sporoblastis pluribus muriformi-dispositis vel oblongæ, diam. 2 – 3½-plo longiores. On trunks of Carya, Santee Canal, South Carolina, *Mr. Ravenel.* Thallus exceeding an inch in diameter, of rather separate, radiose-expanded, somewhat membranaceous but rigid, glaucescent-green lobes, which become narrowed and laciniiform, and more or less ribbed, as well as sparingly divided, and pass into short, erectish, dilated branches or clusters, covered at length and concealed by the crowded apothecia. Gonimous granules concatenate, amongst distinct, much branched, anastomosing, filamentous elements. Apothecia in crowded clusters, very minute, depressed-globose; the concave, or at length flat, dark-reddish disk received in an entire, pale-brownish, thalline exciple. Spore-sacks subcylindraceous, octosporous. Spores at first somewhat square; the four sporoblasts arranged crosswise, but becoming longer and with more and smaller sporoblasts (more or less murally-polyblastish), and at length ellipsoid or oblong-ellipsoid, and from twice to thrice longer than wide; the longer ones sometimes pretty regularly tetrablastish, but the sporoblasts more often, or some of them, divided longitudinally. The affinity of this plant is not doubtful. *C. verruciforme*, Nyl. (*C. furvum*, var. *verruciforme*, Ach.) is its European analogue, differing (as in Schær. Lich. Helv. n. 416, and in the excellent description of Mr. Th. Fries, Lich. Arct. p. 279) in its minuteness, its ascending, densely complicate lobules, and shorter spores, which do not appear to attain to the same development; and an Asiatic also exists, in *C. coccophyllum*, Nyl. Syn. p. 112, from the Nilgherry Mountains in India, presenting spores agreeing exactly (Nyl. l. c., t. 4, f. 20) with the first-described state of the spores of the present, but also, it should seem, not advancing beyond it; with apparently a different thallus. As this last is described, and as *C. verruciforme* is represented in the European specimens, we can scarcely avoid considering the American lichen as, to appearance, and so far as we yet know, distinct.

COLLEMA CYRTASPIS, sp. nov.: thallo mediocri suborbiculari membranaceo-cartilagineo rigido fusco-viridi subtus pallido laciniato-lobato lobis mox angustatis subradiantibus lobulis adscendentibus granulato-rugulosis; apotheciis mediocribus disco convexo nigro-castaneo nitido demum tumidulo marginem thallinum crassiusculum crenulatum excludente. Sporæ octonæ in thecis subclavatis, incolores, subfusiformes, tetrablastæ (3-septatæ) diam. 4–6-plo longiores. On trunks near the ground, in woods; common in Southern Pennsylvania, Maryland, and Virginia. Ohio, *Lea*. Illinois, *E. Hall*, in Hb. Lapham. North Carolina, *Rev. Dr. Curtis*. South Carolina and Georgia, *Mr. Ravenel*. Alabama, *Mr. Peters*. Thallus of middling size (from an inch to an inch and a half in diameter) at first roundish, of cartilagineous-membranaceous, rigid, brownish or blackish green, expanded lobes, which become at length much narrowed, and more or less radiant, passing here and there into short, ascending, branch-like lobules, the dilated and divided summits of which are wrinkled-plaited, and at length densely granulate. Gonidia concatenate. Apothecia of middling size (the largest often a line in diameter), the blackish-chestnut polished disk soon becoming tumid, and quite excluding the originally thick and crenulate thalline margin. Spores in eights, rather broad-spindle-shaped (navicular-subfusiform, *Koerb.*), normally tetrablastish, with regular, mostly roundish sporoblasts, the three dissepiments, obscurely more or less visible, four to six times longer than wide. The almost monophyllous thallus of *C. nigrescens* becomes irregularly somewhat lobed ("lobis cæspitoso-fasciculatis," Sommerf. Suppl. Fl. Lapp., p. 119) in *C. aggregatum*, Nyl. (*C. fasciculare*, var. *aggregatum*, Ach.), and passes, still further, in the present lichen, into at length laciniiform, often radiant divisions. The present is sufficiently distinguished from *C. aggregatum* by its different spores, but in this respect agrees better with the European *C. conglomeratum*, Nyl. Syn. p. 115, t. 3, f. 1 (*C. fasciculare*, var. *conglomeratum*, Ach.), which differs especially in its minute size; the far less divided and less granulate thallus and more entire apothecia ("margine tenui integerrimo," Sommerf. l. c.) being perhaps less to be relied upon.— Growing with the present lichen in

Pennsylvania, and also by itself in New York and Western Massachusetts, I have found another, nearly-related plant, sent to me also from Carolina by Dr. Curtis and Mr. Ravenel; the smaller fronds of which pass almost wholly into short, erect lobules, crowned with "almost contiguous," smaller, and paler apothecia, with thin, entire margins, and containing ovoid, or soon oblong-ovoid (ovoid-ellipsoid) diblastish (once-septate) often nebulose (or, apparently, nebulose-monoblastish) spores, from once and a half to scarcely more than thrice longer than wide, and rather larger gonimous granules; this is probably *C. pycnocarpum*, Nyl. Syn. p. 115, described from a North American specimen in the Paris Museum, and clearly distinguishable, so far as appears, as another link or knot in the knotted line of related forms which we have been considering. *C. pycnocarpum* is not so easily referable to the "genus Synechoblastus" (comp. Koerb. Syst. p. 411); but nothing could be less natural than to separate it generically from the present species, which is clearly a "Synechoblastus." The relation of *C. conglomeratum* of Europe to *C. cyrtaspis* is perhaps the same with that of the European *C. verruciforme* to *C. callibotrys;* and the two foreign lichens might be taken, possibly, for reduced forms of the American; *C. pycnocarpum*, Nyl., being in that case regarded a small form, with simpler spores, of *C. cyrtaspis*. But I am not ready, at present, to go beyond the *distinction* of these states, — a distinction based, as above, in each case, upon a large collection of specimens.

COLLEMA STELLATUM, sp. nov.: thallo cartilagineo firmo viridiglaucescente e laciniis anguste linearibus convexis parce vageque ramosis ramis subsimplicibus vel demum fastigiato-divisis intricatis subtus pallidis canaliculatis; apotheciis mediocribus adnatis rufo-fuscis mox convexis marginem thallinum tenuem excludentibus. Sporæ octonæ, mediocres, incolores, lato-fusiformes, uniseptatæ diam. 2½ – 3-plo l. demum 3½-plo longiores. — On wet rocks, in beds of mountain rivulets, La Perla, island of Cuba, *Mr. Wright*. Occurs in roundish or irregular, rather dense masses of narrow, very sparingly and irregularly branched, convex lobules, the projecting tips of which are either simple, or at length forked, or even fastigiately divided, greenish, or brownish-green, with more or less of a glaucescent tinge above, and paler and channelled below; the gonimous granules being connected in necklace-like strings. Apothecia of middling size, convex. Spores in eights, of middling size, broad-fusiform; once-septate, about thrice, or even thrice and a half, longer than wide. Comparable with *C.*

laciniatum, Nyl. Syn. p. 116, an Alabama lichen, which Mr. Wright has detected in Cuba; but differs in color, in the peculiar habit due to its more simple, elongated, teretish, densely intertangled, substellate, rather than radiant lobes; also in the slenderer filamentous elements, and the constantly once-septate spores. The spores of *C. laciniatum* (Alabama, *Mr. Peters*) are described by Nylander, l. c., as simple or once-septate, and about thrice longer than wide; and I have never observed any differing, unless possibly a little in length; but in the Cuba lichen they become 6-nucleolate and thrice-septate, the length exceeding also more than four times the diameter, — which taken together with the narrower, less uneven lobes, more distinctly channelled beneath, may indicate a variety (var. *solenarium*).

CALICIUM RAVENELII, Tuckerm. in litt.: thallo granuloso glaucescente; apotheciis turbinato-globosis margine incurvo radiato-striatulo stipiteque brevi firmulo fusco-nigris. Sporæ octonæ, fuscescentes, ellipsoideæ) vel fusiformi-ellipsoideæ, simplices, diametro 1½ – 3-plo longiores. On old garden palings, St. John's (Berkley), South Carolina, *H. W. Ravenel, Esq.* Thallus of glaucescent granules (or obsolete). Apothecia smallish, globular, or a little turbinate; the incurved margin radiately wrinkled or striated, and, as well as the short, rather slender, but firm stipe, brownish-black. Spores fuscescent, from ellipsoid becoming irregularly somewhat fusiform-ellipsoid, simple, from once and a half to thrice longer than wide. This species, which is well distinguished by its striated exciple, is dedicated to my valued friend and correspondent, the discoverer.

CALICIUM LEUCOCHLORUM (sp. nov.): thalli granulis in crustam tenuem subcontiguam inæqualem flavidam hypothallo nigro decussatam confluentibus; apotheciis clavato-turbinatis subtus ferrugineis disco nigro stipite valido atro. Sporæ octonæ in thecis cylindraceis, majusculæ, biscoctiformes, diblastæ, medio nunc constrictæ, atro-fuscescentes, diam. 1½ – 2-plo longiores. — On trunks of palm, island of Cuba, *Mr. Wright.* Granules soon confluent, and forming a thin, uneven, pale-yellow crust, irregularly here and there decussated by distinct, black lines (much as in *Lecidea parasema*, var. *exigua*) which I refer to the hypothallus. Apothecia large, from tubular- becoming clavate-turbinate, rusty beneath; the disk flattish, black; the stipes of middling length, stout and strong. Spores larger and shorter than those of *C. hyperellum*, from roundish- becoming short obtuse-ellipsoid, more or less constricted at the middle, or a little longer and more regularly ellipsoid, the tips often acutish; diblastish, at length blackish-brown; the length scarcely exceeding twice the diameter. Nearly akin to *C. hyperellum* and *C. trachelinum*; but differing from both in the crust, and especially in the club-shaped apothecia and large spores, which exceed in size those of *C. roscidum.*

TRACHYLIA LEUCAMPYX (sp. nov.): thallo tenui pulveraceo dein subcontiguo rimoso e viridulo cinerascente; apotheciis minusculis innato-prominulis (subelevatis), disco subplano atro margine intus albo-pruinoso cincto. Sporæ octonæ in thecis lineari-clavatis, e cocciformi mox oblongæ, sæpius 3-blastæ, dein fuscescentes 2- rarius 3–4-septatæ ad septa constrictæ diam. 2–3-plo longiores. On trunks, Monte Verde, island of Cuba, *Mr. Wright.* Thallus very thin, leprous, but becoming here and there compacted and chinky, and from greenish at length ash-colored. Apothecia small, a few of the larger ones occasionally a quarter of a line in diameter, rounded, or occasionally oblong, innate, at length a little elevated in the manner of *T. tympanella*, but (like *T. Javanica* (M. & V. d. B.), Nyl.) not dilated above; the black margin, which, as in *T. Javanica*, is always thicker than in the European species, conspicuously white-powdery within. The elevation of the apothecia is comparatively slight, and often even obscure, and they thus contrast evidently enough with the remarkably conical fruit of *T. Javanica.* Spores in long and narrowed spore-sacks, colorless and smallish at first, and from short-obtuse-ellipsoid (cocciform, *Koerb.*) becoming oblong, and commonly 3-blastish, crossed next by colored, rather irregular dissepiments, and finally dark brown, and for the most part twice, or much more rarely thrice, or even four times septate, and more or less strongly constricted at the dissepiments; the length from twice to thrice, or more rarely four times, exceeding the diameter. This lichen is nearest allied to a curious subtropical type of the Caliciei, found by my liberal correspondent, the late Dr. Joseph Hale, on Cypress trunks in Louisiana, in 1851, and named by me (in herb. Fries), the following year, *Trachylia Pyrgilla.* Mr. Wright has since found the plant not uncommon in the island of Cuba, and he detected it also (as botanist of the U. S. North Pacific Exploring Expedition) in the Bonin Islands, southeast of Japan. From the last, which is inseparable from the American lichen, the Java plant found by Junghuhn, and described by Montagne and Van den Bosch, in 1856, as *Calicium Javanicum* (Mont. Syll. p. 357, M. & V. d. Bosch, Lich. Jav. p. 54) can scarcely differ. Dr. Nylander referred the latter the next year (Monog. Calic. p. 33) to *Trachylia;* and this construction is perhaps still preferable to the opinion expressed later, in his Synopsis (p. 168), that the plant constitutes a genus; the variation from the type of *Trachylia* being only such as might be presumed possible within *Trachylia.* From *T. Javanica* the species above described differs in its thin and powdery thallus (that of the former plant being much better developed, and even approaching, at length, the thickish and warted crust of *T. tympanella*); its much smaller and far less prominent, more conspicuously white-edged apothecia; and especially in the curious differentiation of the spores, which exhibit the blunt ellipsoid (or *biscoctiform*) type of the genus, not merely (as in *T. Javanica*) extended to spores with three dissepiments, but also twice or even thrice constricted. So strange is the effect of this latter variation, that I have hesitated to describe the plant as a lichen; but though there is no coloration of the hymenium with iodine, any more than in *T. Javanica,* both species equally possess an evident thallus; and their apothecia and spores, as already remarked, are explicable as variations from, or rather developments of, the type of *Trachylia tympanella.* — The genus *Trachylia,* as here understood, (indicated by Fries in his Flora Scanica, 1835, and again in his Summa Veg. Scand., 1846, and taken in the same sense by Torssell, a little earlier, and by the present writer in his Synops. Lich. N. Eng., in 1848, as also in the various important works of Dr. Nylander, q. v. in Lich. Scand. p. 44,) appears preferable to the very indefinite *Acolium* of Fée (Ess. Crypt. p. 28, the name adopted being the same as that given by Acharius to the section of his genus *Calicium* which included *C. tympanellum*), as it is also older than the later *Acolium* of Massalongo, &c. And *Cyphelium,* Ach. in Vet. Ac. Handl. 1815 (lately proposed by Th. Fries, in Gen. Heterolich. Eur. p. 100, for the group represented by *T. tympanella*), though it included *Trachylia,* by no means expressed it; and is a less distinct conception.

Cladonia Dilleniana, Floerk.: thallo squamuloso-dissecto, podetiis superne infundibuliformibus prolifero-ramosis, axillis perviis sub-squamulosis e stramineo albicantibus, fertilibus subcymosis; apotheciis fuscis.

a. **crispata**: straminea; podetiis turgidis, axillis apicibusque infundibuliformi-dilatatis foliolis lineari-multifidis exasperatis irregulariter demum proliferis. *C. stenophylla,* Nyl. Syn. p. 201. On rotten logs, Monte Verde, Cuba, *Mr. Wright.*

β. **elongata**: albicans; podetiis gracilioribus subsimpliciter repetito-proliferis elongatis, axillis hiantibus foliolis multifidis cristatis. Coralloides pulchrum geniculis acetabuliformibus crispifoliosis. Dill. Hist. Musc., p. 100, t. 16, f. 23. Floerk. Clad. l. c. On rotten logs, Monte Verde. Thallus of rather elongated, much and narrowly-lobed squamules, which are greenish-straw-colored above, and very white beneath. Podetia, in the more simple states of *a*, turgid, and dilated above into funnel-shaped expansions, which are finally more or less irregularly proliferous-ramose, and, as well as the dilated axils, often squamulose; the fertile ones at length much divided above and crowned by the clusters of brownish (from pale at length dark-brown) apothecia. This state, which exceeds at length four inches in height, appears quite analogous to *C. furcata*, var. *crispata*, though the larger and more branched specimens are more readily comparable with fine ones of *C. uncialis*, var. *turgescens*. Var. *β* is a paler, more slender, much elongated form, attaining to the height of eight inches; the less dilated, often subcylindrical podetia extended upwards by commonly a single proliferation, and the gaping but not dilated axils elegantly fringed by the dissected squamules already described, which retain above their greenish hue, and thus contrast pleasingly with the white podetia. The scyphiform-dilatation of the podetia above, which is more or less evident in *a*, as in the already cited form of *C. furcata*, disappears at length entirely in *β*, as in *C. furcata*, var. *racemosa;* but the Cuban lichen differs from the latter (occurring in an equally fine condition in Venezuela, *Mr. Fendler*) in a simpler and less-branched habit, in color, and in the elegant fringe of squamules which borders (and often conceals) its gaping axils. It is this last, most developed condition of the lichen, as I think scarcely doubtful, which Dillenius describes and figures, from a specimen brought by Catesby from the Isle of Providence. He places it next to, and compares it with, *C. uncialis*. But Floerke more satisfactorily referred the described plant, which he had not seen, to his "Cladoniæ infundibuliformes," placing it next to *C. squamosa;* and remarking, in a note at the end, that *C. furcata*, var. *crispata*, in itself considered, would scarcely be separable from the same section. The cited variety of *C. furcata* is represented in North America by a rich series of forms; and one of these from the New England mountains, with the axils crested with dissected squamules, is exceedingly like, except in the important respect of color, small states of the present. *C. furcata*, var. *cristata*, Fr., also an inhabitant of our mountains, is a form of the last-mentioned variety in which the dilated axils, and especially apices, are fimbriate-cristate; but the crests are due here (so far as my specimens go) solely to an excessive proliferation of the margin. Fries (Index Dillenianus, in Lich. Eur. p. 464) has referred the Dillenian lichen to *C. verticillaris*, Raddi; and Nylander (Syn. p. 192) takes the same view: but the last-named plant possesses true scyphi which are proliferous from the centre, and the fringe-like extension of the margins of these scyphi differs entirely from the crest of dissected squamules which borders the axils (as fully described and figured by Dillenius) of *C. Dilleniana*. *C. stenophylla*, Nyl. l. c., was founded on the first-received, smaller specimens of our *a*, which were on several accounts puzzling, and scarcely to be referred to any known species; but these are now fully explained by Mr. Wright's further collections, and the correctness of Floerke's opinion as to the Dillenian plant, if I mistake not, sufficiently established. The species is worthy to be adorned with the name of the illustrious author of the Historia Muscorum.

CLADONIA HYPOXANTHA, sp. nov.: thallo parvulo cæspitoso subfoliaceo; foliolis lineari-angustatis elongatis ramoso-multifidis margine crenulatis supra viridi-stramineis subtus fusco-aurantiis podetia turbinato-cylindrica cartilagineo-corticata verrucoso-rugulosa scyphis concavis margine subradiatis aut obliteratis apotheciis coccineis proferentibus. On trees in dense woods, Monte Verde, island of Cuba, *Mr. Wright*. Folioles (scarcely exceeding half an inch in length, the podetia being about a quarter) palmately or pinnately many-cleft; the elongated, branched, plano-convex or flattish divisions finely crenulate; greenish-glaucescent, or, at length, straw-colored above, and beneath convex, or at the base teretish, and brownish-orange, with white edges. Podetia short, rather slender, subturbinate, verrucose-rugulose, the scyphi at length sparingly radiated, or obliterated. Apothecia scarlet. Folioles comparable rather with the dissected squamules of *C. squamosa*, than with those of *C. alcicornis;* and it is possible that the lichen may be rather a macrophylline form of some species (unknown as yet as to Cuba, or, I think, Tropical America) analogous to *C. cornucopioides* in Northern regions, than an analogue of the typically macrophylline species of the glaucescent series. Epiphylline forms, with reduced folioles, also occur, and these suggest similar ones of *C. cornucopioides*. But the characters of the plant are too striking not to require separate notice. *Cenomyce corallifera*, Kunz. msc. in Herb. Berol., from Surinam (Weigelt, 1827), is very probably a state, with better developed podetia, and reduced or squamulose, convex folioles, of the present;

and, except as regards the squamules, is also similar to small forms of *C. cornucopioides*.

CLADONIA CRISTATELLA, Tuckerm. Suppl. 1, in Amer. Journ. Sci. 25, p. 428, char. emend.: thalli squamulis firmis crenatis mox subelongatis incisis; podetiis ascyphis validis ventricoso-cylindricis cartilagineo-corticatis glabris e flavo- mox pallido-virescentibus apice dilatato digitato-subdivisis, ramulis fastigiatis fertilibus; apotheciis coccineis. *C. Floerkiana*, Tuckerm. Syn. p. 55, & Exs. n. 133, non Fr. On dead wood; and on the earth. New England to Virginia, very common. Westward to Indiana, Herb. Van den Bosch; Wisconsin, *Mr. Lapham;* and Lake Superior, *Prof. Agassiz.* Southward, small forms occur (North Carolina, *Rev. Dr. Curtis;* South Carolina and Georgia, *Mr. Ravenel;* Alabama, *Mr. Peters*), apparently belonging here; but the species is a Northern one, and the Southern lichen taking its place more commonly exhibits the peculiar features of *C. pulchella*, Schwein., which is rather to be regarded a northern state of the subtropical *C. muscigena.* Thallus of small, firm, crenate, or at length a little elongated and lobed squamules, colored like the podetia above, and white below. Podetia ventricose-cylindrical, becoming often more or less regularly elongated-turbinate; the largest specimens two inches long and three or even four lines in diameter at the thickest part below the branches, but passing into slender and shorter states; with a smooth, but at length verruculose (never mealy) or even subsquamulose epidermis; the squamules being, however, rarely other than adnate, and the whole aspect rather glabrous; from greenish-yellow becoming pale-green (varying also to greenish-glaucescent, or even cinerascent) dilated at the apex, which is never scyphiferous, and passing there into subdigitate, fastigiate branchlets, always crowned by the scarlet apothecia. The name now applied to the above-described lichen was originally proposed by the writer to distinguish a remarkable state which has proved to be inseparable from the other, this last having passed, with especial reference to its paler, more slender condition, for an American form of the European *C. Floerkiana*, Fr. But the affinity of a plant is to be determined, not by its individual peculiarities, which may apparently relate it to other types, but by its own type, which it may quite imperfectly express. And the type of the dwarf forms of the lichen before us, which have been referred to *C. Floerkiana*, is really remote from the type of the latter. *C. Floerkiana* (Fr. Lich. Suec. n. 82. Schær. Lich. Helv. n. 36, pro parte) is, in fact, scarcely more than a smoothish state of *C. macilenta* ("verbis magis quam re vera diversa," Th. Fr. Lich. Arct. p. 156); while most perfectly developed specimens of the American lichen are, as respects color, size, and, quite commonly, shape, so similar to fine ones of *C. cornucopioides*, as to be readily at the first glance mistaken for the latter, or even — the constant dissolution of the scyphus in *C. cristatella* being interpreted as in some other species — plausibly to be reckoned a hitherto unknown, symphycarpious variety of it. Such symphycarpious states should, however, be connected with the scyphiferous states from which they descend by intermediate conditions; and these appear to be wholly wanting in *C. cristatella*, as in *C. mitrula;* both being always ascyphous, and the dissolution of the apices into branchlets appearing therefore to be, in both cases, normal.

b. RAMOSA: podetiis cæspitose-conjunctis hic illic inferne patulo-ramulosis superne demum sub-dichotomo-divisis. *C. cristatella*, Tuckerm. l. c. On the earth, in sterile places; White Mountains, *Oakes*. Subcæspitose; the podetia here and there sending out short branchlets below, not unlike similar ones in some fruticulose species; and above, very much dichotomously divided. A luxuriant form of *a*, exhibiting sometimes an approach to a fruticulose habit, and the axils now and then subperforate. The apices are commonly much more divided than in *a;* but the cristate habit, which suggested the name, is also conspicuous in the latter.

c. OCHROCARPIA, apotheciis carneo-luteolis. *C. Floerkiana, ochrocarpia*, Tuckerm. Exs. l. c. *C. substraminea*, Nyl. Syn. p. 204. On the earth in high, sterile regions, many years since burnt over, on the lower ridges of the White Mountains (Mount Crawford); frequent, in various states, and passing directly into *a*. Less common in lower districts. Saratoga Springs, New York. Manchester, Massachusetts, *Mr. Oakes*.

CLADONIA GRACILENTA (sp. nov.): thalli squamulis minutis laciniatis stramineis subtus albis; podetiis scyphiferis elongatis gracilibus membranaceo-corticatis glabris stramineis (flavidis) vage elongato-ramosis, ramis patulis intricatis hic illic ramulisve subulatis; scyphis angustatis margine dentato proliferis, fertilibus superne incrassatis fimbriato-radiatis; apotheciis coccineis. Rotten logs in the edge of savannas near Sagra, island of Cuba, *Mr. Wright*. Thallus minute, of scattered, at first crenate, but finally linear-lobed, thin, straw-colored scales. Podetia slender, or very slender, and much elongated (reaching six inches in length); the thin, smooth epidermis becoming here and there uneven, but not squamulose; straw-colored, becoming pale-yellow towards the summits; dividing sparingly and irregularly into elongated, spreading, more or less intertangled branches, which are mostly scyphiferous, but occur occasionally with subulate tips. Sterile scyphi very small, proliferous from the margin (or very rarely from the centre), toothed; the teeth often crowned with the spermagones. Fertile podetia somewhat dilated, especially above, when the epidermis becomes less regular, and the axils are sometimes (atypically) perforate; the scyphi, by prolification from the margin, becoming in this condition much divided or fimbriate-radiate. Apothecia scarlet. As *C. leporina*, Fr., represents *C. rangiferina*, in the scarlet series, the present may be taken as analogous, in that series, to *C. gracilis* in the *Fuscescentes*, Fr., and *C. amaurocræa* in the *Ochroleucæ*. It is slenderer than the last-named, but sometimes not wholly unlike it. Of the scarlet-fruited group, *C. bellidiflora* is possibly nearest, and passes into states distantly approaching some specimens of the present, but the former is confined to arctic and alpine districts; and the extreme slenderness and smoothness of the delicately-corticate, long-branched podetia of *C. gracilenta*, and their different habit, is quite enough to separate this inhabitant of tropical savannas.

DACTYLINA, Nyl. Syn. p. 286. — The genus *Dufourea* was proposed by Acharius (Lichenogr. pp. 104, 524, t. 11, f. 2) for a Cape of Good Hope lichen (*Parm. mollusca*, Ach.) akin to *Roccella*, which has since been separated by De Notaris as *Combea*. Only this was illustrated by the author, as expressing the type of the new genus; and though he associated with it a plant not congenerical (*P. flammea* (L.), Ach., also from the Cape, the spores of which relate it to *Physcia parietina*), and even gave precedence to this last in the Synopsis, the citation here, immediately after the name of the genus, of his figures (of *D. mollusca*) in the Lichenographia, apparently showed that his type remained the same. It is not, therefore, without reason that Mr. Th. Fries (Genera Heterolich. Eur. p. 113) proposes to retain *Dufourea* for *D. mollusca*. But Acharius added to the above-named, as "species dubiæ," several lichens of more or less similar habit, the fructification of which he was unacquainted with, and one of these (*D. madreporiformis*), though still only known in a sterile condition, which can ill determine a generic type, has represented *Dufourea* with many lichenists. To this, the remarkable lichen of Arctic America upon which

Dr. Nylander has founded his distinct genus *Dactylina*, stands in obvious affinity; and the equally obvious differences of the two plants seem to be fully mediated by our second species, fertile specimens of which were first detected on islands of Behring's Straits, by the careful eye of Mr. Wright.

DACTYLINA ARCTICA (Hook.), Nyl. l. c. *Dufourea*, Hook. in Richards. Append. to Frankl. Narr. p. 762, t. 31. *Evernia*, Tuckerm. Syn. p. 11. Bear Lake and elsewhere in Arctic America, *Richardson*. Rocky hill-sides, Behring's Straits, *Mr. Wright*. Thallus becoming erect, simple, or very sparingly divided, ventricose, smooth and shining, rather attenuated above towards the obtuse apices, pale yellow, becoming brownish at the base, within hollow, the medullary filaments only thinly or even obscurely clothing the walls. The taller of these specimens rather exceed two inches in height, by two to three, or at the base four lines in width; but they reach nearly twice these dimensions (Hook., Nyl.). Rarely, specimens are more divided above, the (2 or 3) simple branches showing something of the fastigiate habit of *D. madreporiformis*. Apothecia largish (two lines in diameter in my fertile specimen), a single one occupying the summit of a branch, or branchlet, which is wrinkled below and passes above into a crenulate, at length obscure margin, enclosing the flat, shining, dark chestnut-colored disk. Spores in eights, in somewhat ventricose or wedge-shaped spore-sacks, small, colorless, spherical, limbate; the paraphyses being indistinct. Spermogonia unknown.

DACTYLINA RAMULOSA. *Dufourea ramulosa*, Hook. Append. to Parry's 2d Voy. p. 414. *Evernia*, Tuckerm. Syn. p. 11. Arctic America, Hook., l. c. Rocky Mountains, Herb. Hook. Hill-sides (on rocks), Behring's Straits, *Mr. Wright*. Thallus very much smaller than in the last (the specimens scarcely exceeding half an inch in height, except in the branched state, when they do not exceed an inch), but at first not wholly unlike it; the inflated and rarely somewhat finger-shaped, obtuse branches becoming, however, soon nodose (it would be interesting to compare here the scarcely known *Dufourea nodosa*, R. Br., in Ross's Voyage) and lacunose-uneven, and passing into the dichotomously branched state, almost muricated with short, elongated-papilliform branchlets, which is, if I mistake not, (the specimen from the Hookerian Herbarium referred here being without name,) the type of the species as understood by Hooker. Some of the specimens of the simpler condition are pale straw-colored, the tips only being brownish; but the latter hue soon prevails, and becomes at length, in the fully developed dichotomous lichen, olivaceous-brown. Within, the branches are hollow, as in the last, the wall being clothed with a thin web of medullary filaments. Apothecia either lateral, and clearly sessile, or terminating branches, when they appear sometimes as if stalked; the shining, chestnut disk at length equalling the crenulate, thalline margin. Spores in eights, in cuneate-clavate spore-sacks, spherical, like those of the last; but occurring also, now and then, a little oblong. *Dufourea ryssolea*, Ach. Lichenogr. p. 525 (not, as is affirmed in the Index Dillenianus of Professor Fries, Lich. Eur. p. 468, the plant of Dill. Hist. Musc. p. 545, t. 82, f. 4, which seems clearly to be *Cetraria Richardsonii*, Hook.), from Siberia, appears almost to approach, so far as the brief character goes, to some less developed states of the present, but is really, according to Dr. Nylander (Syn. p. 397) a *Parmelia*, nearly related to *P. olivacea;* the branches of *D. ramulosa* being in fact, as already remarked, mostly hollow, or in the narrower forms only very loosely webby within, and by no means, as Acharius describes his plant, "*sub*fistulosi, tela bombycina *farcti*." But I possess a lichen from Tyrol, collected by Funk, (probably *Dufourea muricata*, Laur. in Sturm D. Fl. 2, 24, t. 12, but my specimen, instead of being straw-colored, is rather olivaceous-brown, often more or less white-pruinose,) which possibly differs from the next (as Laurer's is said to) in having a rather looser medullary web, or in being even subfistulous, and in other respects sufficiently resembles specimens of *Dactylina ramulosa.* The last-named lichen is clearly congenerical with *Dactylina arctica*, and it also nearly approaches the next.

DACTYLINA MADREPORIFORMIS. *Lichen madreporiformis*, Wulf. in Jacq. Coll. 3, t. 3, f. 2. *Dufourea*, Ach. Lichenogr. p. 525; Syn. p. 247; Koerb. Parérg. p. 15; Nyl. Syn. p. 287. *Cladonia*, Schær. Spicil. p. 48, & Lich. Helv. n. 85. *Evernia*, Fr. Lichenogr. p. 25. *Cetraria nivalis*, var. *madreporiformis*, Schær. Enum. p. 14. On the earth, on alpine ridges east of Middle Park, Rocky Mountains; sterile; *Dr. C. C. Parry.* Thallus softish, turgid, about an inch in height, rather sparingly, subdichotomously divided; the branches short, lacunose-uneven, obtuse, ochroleucous; the medullary filaments rather closely filling the interior, which is seldom subfistulous. Apothecia unknown. Readily distinguishable from the others by its paler color, and from the last by its simpler habit, and more compact medullary tissue. The place of the species just referred to being determined, I cannot hesitate to place this next to it, and in the same genus.

Parmelia Japonica, sp. nov.: thallo foliaceo-imbricato subcoriaceo lævi glaucescente, laciniis sinuato-multifidis moniliformi-constrictis plano-convexis apice palmato-cristulatis subtus albis pulvinulis spongioso-pannosis fusco-atris interrupte tectis; apotheciis mediocribus spadiceis margine incurvo subcrenato. On birch trunks at the summit of mountains, N. E. of Hakodadi, Japan, *Mr. Wright.* Thallus more rigid than that of *P. physodes*, and agreeing rather in this, as in some other respects, with *P. colpodes*, from which it differs in the remarkable constriction of its narrowed, many-cleft lobes into short, joint-like, wedge-shaped, or irregularly-rounded portions, — a feature noticeable throughout, but especially so in the repeatedly-palmate or crested apices, — and in the spongy hypothallus (consisting, like that of the American lichen, as described by Nylander, l. c. p. 404, of much-branched, anastomosing, short-jointed, brown filaments) being broken up into separate, roundish-irregular, convex cushions. The only published species with which I can compare this is *P. moniliformis*, Babingt. N. Zeal., p. 23, t. 127, f. 3, referred to the older *P. angustata*, Pers., by Nylander, Syn. p. 403), the lobes of which appear by the description to be "constricted, especially towards the apices, or even moniliform-constricted," and the underside clothed "interruptedly with spongy pulvinules" (Nyl. l. c.). But the plant of Babington, as figured, is a small lichen of the ochroleucous series ("facie fere *Parmeliæ incurvæ*," Nyl. l. c.) with "attenuate apices"; while the present belongs to the glaucescent series, and has the size and aspect of the finest conditions of *P. physodes* and *P. colpodes.* I have entirely failed to detect spores in the apothecia of either of the five specimens. The spores of *P. colpodes*, which are crowded in large numbers in the polysporous, wedge-shaped spore-sacks, are more or less oblong or fusiform-oblong, and soon hooked or crescent-shaped; the length from three to six times exceeding the diameter. Those of *P. physodes*, on the other hand, occur in eights, and vary from spherical to ovoid; and those of *P. angustata*, as described, appear to be similar.

PHYSCIDIA, Genus novum. Apothecia scutelliformia, excipulo thallino recepta. Discus ceraceus, hypothecio tenui strato medullari imposito enatus. Sporæ aciculares incolores. Thallus foliaceus, expansus, hypothallo byssino pannoso-intertexto aut crustaceus subsquamaceo-granulosus. Habitu ad Physciam proprie sic dictam accedit, at distincta hypothallo sporisque.

PHYSCIDIA WRIGHTII. *Physcia? Wrightii*, Tuckerm. Suppl. 2, in Amer. Journ. Sci., 28, p. 204. On various trees, in dense woods, in the island of Cuba, *Mr. Wright.* Thallus foliaceous (with much of the aspect of *Physcia* proper, as also of smooth states of *P. Domingensis*, Montag.), suborbicular, thin, narrowly lobed; the largest states four inches in diameter, and the flat or flattish lobes often exceeding, in such states, a line in width, but perhaps as common in smaller and more narrowly divided conditions; imbricated now closely, with even a subconnate aspect, and now very loosely, when the delicately linear lobes appear often as if ciliated; irregularly and above somewhat palmately many-cleft; sending out here and there terete, simple, or rarely a little branched, finally crowded, coralloid branchlets, the longest of which exceed three lines in length; from pale greenish becoming greenish-straw-colored (the larger states often darker, or even glaucescent), and at length a little yellowish, when the color of the fruit is also intensified. Hypothallus of very delicate, colorless, much-branched, anastomosing filaments (resembling those of *Parmelia* (*Amphiloma*) *gossypina*, Montag. Cub. p. 217, but less slender), which are closely intertangled into a sometimes dense, but more commonly thinnish, and at length even obsolescent web. Apothecia scattered, middling-sized (about a line in diameter), or largish; the inflexed, plicate-crenulate (or, as it were, effigurate) margin becoming flexuous-lobulate, when the exciple reaches two or even three lines in diameter; the naked, waxy disk varying in color from pale yellow to orange, and imposed upon a thinner, colorless hypothecium, which rests upon the white medullary layer. Spores in eights, in club-shaped spore-sacks, smallish, colorless, acicular, commonly tri-septate (tetrablastish), but at length (if I mistake not) pluriseptate (pleioblastish), the length from eight to sixteen times exceeding the diameter. Paraphyses indistinct. Spermogones not observed. — But beside this typical condition of the plant before us, there occurs (and is represented by a large set of specimens) another, which, though inseparable in essential characters, differs so much as to appear at first sight scarcely congenerical. "Hypothallus optimas præbet differentias, sed in speciminibus perfectis et junioribus observandus." Fr. Lich. Eur. p. 130. It has been observed already, that the lichen above described recedes obviously from *Physcia* in its pannose hypothallus, in which it approaches *Pannaria*, and especially the aberrant tropical type (*Parm. gossypina*, Montag.) which Dr. Nylander (Enum. Gen. p. 110) has provisionally connected with his genus *Am-*

philoma. And *Pannaria* (proper) furnishes similar degenerations of the foliaceous type to that we are about to describe, but scarcely a hypothallus offering in the young state the precise features of this.

PHYSCIDIA SQUAMULOSA, sp. nov.: hypothallo fibrilloso radiante demum byssino-pannoso granula squamacea albida mox lobulata ramulis coralloideis nunc obsessa crustaceo-coacervata proferente; apotheciis planis crenulatis dein flexuoso-lobatis subaurantiis. Sporæ aciculares, gracillimæ, diam. 6 – 12-plo longiores. On trees, in dense forests in Cuba, *Mr. Wright.* Thallus crustaceous, of minute, roundish scale-like granules, scattered over the hypothallus (which does not attain at once to its pannose development, but appears at first as rather sparse, elongated, radiant, white fibrillæ), becoming later lobulate, and often beset with coralloid branchlets, as in *P. Wrightii*, and finally crowded together into a granulose white crust. Apothecia very like those of *P. Wrightii* and equally large, perhaps more commonly orange: spores as in that, or possibly a little slenderer. As respects habit, a *Lecanora;* but in fact a degeneration of the foliaceous type expressed by *Physcidia Wrightii.* Large sets of specimens of both lichens have afforded me no clear indication of the passage of one into the other; but such passage appears probable.

PANNARIA FLABELLOSA, sp. nov.: thallo minuto livido-cinerascente, laciniis lineari-angustatis dissectis, centralibus teretiusculis congestis, periphericis flabelliformi-expansis planis striatis, hypothallo viridi-cærulescente; apotheciis minutis biatorinis sparsis, margine integerrimo mox viridi-cæruleo (nigro) discum planum rufum (nigricantem) vix superante. Sporæ octonæ, oblongo-ellipsoideæ, dein subdactyloideæ, tetrablastæ, diam. 2½ – 3-plo longiores. On talcose schist and on granite in Vermont, *Mr. Frost.* A minute species, occurring in rounded or irregular patches, smaller in its parts than *P. crossophylla;* found on similar rocks in Vermont by Mr. Russell, and described in this journal, 4, p. 404, — and comparable rather, except as regards size, with *P. tryptophylla;* from which it differs in the color and division of its thicker, narrower, plano-convex, or, in the circumference, flat, but never concave, finely striate lobes, which never become granulose-corallinoid. The apothecia are not a little like those of *P. nigra* (Huds.), Nyl. Lich. Scand. p. 126 (*Collema nigrum*, Ach.; *Parm. tryptophylla*, var. *corallinoides*, Auct.), with which (separated by Koerber and other late writers as a distinct generic type of Collemacei) the spores also appear to connect it. But the thallus sufficiently distinguishes the present plant, which is properly, if I mistake not, inseparable from *Pannaria*. Gonimous granules bluish-green, several not unfrequently concatenate.

COCCOCARPIA STELLATA, Tuckerm. in litt.: thallo parvulo orbiculari membranaceo plumbeo, laciniis radiantibus lineari-angustatis multifidis subtus albis fibrillosis; apotheciis sessilibus rufo-fuscis (nigricantibus) subtus albo-fibrillosis. On Holly (*Ilex opaca*), Santee Canal, South Carolina, *Mr. Ravenel*. The larger fronds scarcely surpassing half an inch in diameter, rather darker than *C. molybdæa*, and conspicuously differing from the small forms of this last, which often accompany it, in its linear, many-cleft lobes. The apothecia are also scarcely appressed, but they possess the other features of those of *C. molybdæa;* and exactly similar ones, which are also fibrillose beneath, occur in an Alabama specimen of the latter, collected by Mr. Peters. Spores immature in all the apothecia examined.

LECANORA ERYTHRANTHA, sp. nov.: thallo crustaceo tenui rimuloso albo-glaucescente; apotheciis mediocribus sessilibus, disco plano marginato fulvo-miniato margine thallino crenulato tenuescente. Sporæ octonæ, incolores, ellipsoideæ, polari-diblastæ, diam. 2 – 2½-plo longiores. On trunks, island of Cuba, *Mr. Wright*. *L. aurantiaca*, on bark (occurring in the low country of Carolina, in Louisiana, and in Texas), is undoubtedly near to this, but contrasts strongly with it in its black hypothallus, yellow thallus, and orange fruit. The present and the two following species belong to a group, which on the one hand appears almost to descend from the yellow *Placodiums* and *Physciæ* (these closely akin elements of the system are brought together in *Physcia*, Massal., and perhaps more happily in *Xanthoria*, Th. Fr.), while it passes, on the other, into conditions not at first sight to be distinguished from *Lecidea*. The group is understood to constitute several genera, in the system as developed by the school of Massalongo (though these genera, and, in addition to them, *Amphiloma*, Koerb., and *Pyrenodesmia*, Massal., are now brought together in one, in the "*Placodium*" of Anzi, Cat. Lich. Sondr. p. 39,—an arrangement determined solely by the spores): but the not inconsiderable difficulties of this disposition are perhaps to some extent avoided by the simpler view of Dr. Nylander (Enum. Gen. p. 112), which accords very much with the profoundly considered arrangement of Fries (Lich. Eur. p. 161).

LECANORA FLORIDANA, sp. nov.: thallo parvulo crustaceo tenui contiguo inæquabili glauco-cinerascente hypothallo nigricante sublimitato; apotheciis minutis adnatis, disco plano fusco-nigro opaco submarginato marginem thallinum integrum demum subcoloratum æquante. Sporæ octonæ, incolores, ellipsoideæ, polari-diblastæ, diam. 2-plo longiores. On trees, Western Florida, *Mr. Beaumont.* On bushes, thickets of the Blanco, Texas, *Mr. Wright.* Thallus thin and smooth, becoming ash-colored, limited more or less by the blackening hypothallus. Apothecia small and closely sessile, lecanorine; the flat, nearly black, opaque disk scarcely or indistinctly marginate; but the rather thickish and entire thalline exciple at length more or less colored. A small lichen with much of the aspect of some states of *L. sophodes*, but the spores of the present section.

LECANORA CAMPTIDIA, sp. nov.: thallo crustaceo tenui inæquabili dein rimuloso cinereo-fuscescente hypothallo nigro sublimitato; apotheciis mediocribus biatorinis sessilibus, disco plano-convexo rufo-fusco albo-pruinoso marginem integrum albidum mox flexuosum fuscescentem demum superante; excipulo thallino excluso. Sporæ octonæ, incolores, ellipsoideæ vel oblongo-ellipsoideæ, diam. 2 – 3-plo longiores. On various trees, and on rails, in Southern Pennsylvania, Maryland, and throughout Virginia (Alexandria, near Richmond, and in Sussex County), where it becomes common. North Carolina, *Rev. Dr. Curtis.* South Carolina, *Mr. Ravenel.* Texas, *Mr. Wright.* Thallus thin, smooth, becoming chinky and at length much broken, and more or less brownish-ash-colored; the hypothallus, which sometimes appears as a white fringe, at length blackening, and in that way conditioning the thallus, which it sometimes decussates. Apothecia of middling size, biatorine, sessile, the smooth and entire, at first nearly white, but soon fuscescent and flexuous margin, at length exceeded by the plano-convex reddish-brown disk, which is besprinkled with a white, fugacious bloom; the thalline exciple for the most part quite obsolete, but sometimes obscurely recognizable as a depressed crenulate border; or much more rarely (as in *L. ferruginea*) conspicuous, when the apothecium becomes zeorine, or lecanorine, according as the proper margin is more or less evident. The lichen is thus (like *L. ferruginea*) now, in its lecanorine state, a *Callopisma* of Koerber; and now, in its lecideine condition, a *Blastenia.* In its more perfect states this species is sufficiently distinct-looking; but small forms are not unlike *Lecidea spadicea*, Ach., and large ones may sometimes be passed over for *Lecanora subfusca.*

LECANORA BERICA. *Maronea Berica*, Massal. in Flora, 1856, n.

19. Koerb. Parerg. p. 90. *Lecanora constans*, Nyl. Prodr. Gall. p. 89; & Lich. Par. n. 124. *Maronea Kemmleri*, Koerb. l. c. p. 91. *Lecanora polyphora*, Tuckerm. in litt. On trunks and dead wood. (Italy, Massal. l. c. France, Nyl. l. c. Germany, Koerb. l. c.) Not uncommon in New England, and southward to Virginia. Pennsylvania, *Dr. Michener*. Ohio, *Lea*. North Carolina, *Rev. Dr. Curtis*. South Carolina, *Mr. Ravenel*. Alabama, *Mr. Peters*. Thallus smallish, verrucose-granulate, the granules now and then flattened, or even subconfluent, often at first greenish-gray, but with more or less of an ashy tinge, which finally (the hypothallus more strongly conditioning) prevails, and becomes even fuscescent, limited, rather conspicuously, by the blackening hypothallus. Apothecia of middling size (often large for the plant, the diameter exceeding half a line), sessile, lecanorine, or more or less perfectly zeorine; the flattish, brownish-black, opaque disk, which is received in a stratum of the medullary layer, submarginate, and bordered by a thickish or even tumid, inflexed, finally crenulate, or flexuously-irregular margin. Spores very numerous, in lanceolate-clavate spore-sacks, very minute, colorless, from roundish-ellipsoid becoming a little oblong, twice or even twice and a half longer than wide, and finally diblastish. A plant which Dr. Koerber has thoroughly described; but his second species (*Maronea Kemmleri*) scarcely indicates anything more distinct than a state of the first, in which the proper margin, perhaps always potentially present, and by no means rarely observable, becomes especially developed. Such states occur here, but they are not separable from the others. The lichen has the aspect of a common bark form of *L. sophodes*. The spores are described as simple by all the authors who have remarked upon them, but I cannot but consider the protoplasm ("so weit es erkannt worden kann, grösstentheils wolkig-trüb," Koerb. sub *Maronea Berica*, l. c.) as dividing finally into two pretty regular, opposite parts, as observable as could be expected in so minute an object, and in the European as well as the American specimens; this differentiation of the spore resembling that of the younger conditions of the biscoctiform type; as if, in fact, the plant were a remarkable micro- and polysporous deviation from the type of *L. sophodes* (*Rinodina*, Massal., Koerb.), in which the final development of the spore peculiar to that type has been precluded, rather than from the type of *Lecanora* proper. *L. sophodes* varies with spore-sacks containing twenty or more spores; and is also comparable with the present in its often luxuriantly fertile hymenium.

THELOTREMA, Ach. Nyl. Some of the species differ no little in aspect from the well-defined *T. lepadinum*, Ach.; and Fée (Ess., Suppl. p. 88) and others have proposed to separate the latter generically. But though the distinction of the excipular margins is often obscure in the tropical species, and these vary also very considerably in the figure, coloring, and internal differentiation of the spores, which are commonly smaller and more simple than those of *T. lepadinum;* it appears to me that the Cuba lichens referable here, in accordance with Dr. Nylander's limitation of the genus (Enum. Gen. p. 117), or, at least, those of which the descriptions follow, are none of them properly separable from it, or from *T. lepadinum.* And this view is, if I mistake not, in full accordance with Eschweiler's laborious observations (Lich. Bras. p. 173).

THELOTREMA LEPADODES, sp. nov.: thallo effuso tenuissime membranaceo diffracto cinereo-albicante; apotheciis submediocribus superficialibus e conoideo tympaniformibus, apertura ampla excipulo exteriori urceolato albido (fuscescente) thallo vestito discum nigricantem albo-pruinosum excipulo interiori discreto membranaceo albo marginatum margine demum subrecurvo integro cingente. Sporæ suboctonæ in thecis clavatis, majusculæ, fuscescentes, oblongæ, serialiter polyblastæ (ser. transversis 16–24, longitudinalibus in medio 4), diam. 3–5-plo longiores. On trunks, Filanthropia, island of Cuba, *Mr. Wright.* Thallus membranaceous, much and finely broken, or scurfy, ashy-white. Apothecia a third of a line in diameter, superficial; the younger ones exactly truncate-conoidal, but the oldest more cylindraceous or drum-shaped, with an ample aperture; a proper urceolate exciple, more or less clothed by the thallus, but occasionally denuded and fuscescent above, bordering with an entire, finally a little recurved margin a blackening white-pruinose disk, which is itself loosely edged by a white, membranaceous, inflexed, sometimes obscure interior exciple. Spores large, fuscescent, oblong, serially polyblastish. Paraphyses filiform, flexuous. Appearing at first sight to differ from *T. lepadinum*, mainly in the more erect, finally recurved outer margin, and the colored and otherwise somewhat discrepant spores; but the real difference is, if we accept the common definitions of *T. lepadinum*, much greater; the so-called thalline, outer exciple of the latter being represented in the present by what is plainly a proper exciple; that is, one not formed from the thallus, though more or less covered by it. This structure (that is to say, a sporigerous disk, veiled by a more or less distinct interior exciple, and contained by a proper exciple, clothed by or concrete with the thallus surrounding it) is, however, though very variously conditioned, and often in this or that respect obscurely expressed, (the interior exciple being now scarcely distinguishable, and now the proper exciple, and the thallus now so predominant as to give a lecanorine character to the apothecium, and now without any other than an accidental relation to the apothecium,) if I do not mistake, the typical structure of the genus; and recognizable even in the well-known species, common to the Northern hemisphere, cited above.

THELOTREMA PLATYCARPUM, sp. nov.: thallo effuso tenui lævigato dein ruguloso pallido (subfuscescente); apotheciis majusculis innatis dilatatis subscutelliformibus, disco plano cæsio-pruinato excipulo interiori membranaceo viridulo inflexo cincto, exteriori reflexo substellatim fisso. Sporæ octonæ, parvulæ, leviter fuscescentes, oblongo-ellipsoideæ, tetrablastæ, diam. 2½ – 3-plo longiores. Trunks, in the island of Cuba, *Mr. Wright.* Thallus thin and often obscure, but becoming interruptedly thicker, and at length rugulose, and pale-brownish-cream-colored. Apothecia large, reaching a line and a half in diameter, innate, much dilated; the flat, thin, pale-fuscescent disk, which becomes blackish above and delicately pruinate, bordered by the thin, obscurely greenish, erose, inflexed margin of the interior exciple; the exterior margin splitting in a somewhat stellate manner into reflexed divisions. Spores small, slightly fuscescent, oblong-ellipsoid, often a little narrowed towards one end or dactyloid-ellipsoid, from diblastish (when a thin dissepiment is observable) becoming finally and regularly tetrablastish, the sporoblasts roundish. Paraphyses filiform, conglutinate. The near affinity of this elegant *Thelotrema* to *T. lepadinum* can scarcely be denied, notwithstanding the marked divergence of its spores.

THELOTREMA SANTENSE, sp. nov.: thallo crassiusculo tenuissime ruguloso excrescentias coralloideas proferente e glaucescente demum cinerascente; apotheciis majusculis innatis urceolato-scutelliformibus dilatatis, apertura amplissima, disco plano nigro albo-pruinoso excipulo exteriori incurvo lacero-crenato cincto, interiori indistincto. Sporæ octonæ, fuscæ, ovoideo-ellipsoideæ, demum oblongo-ellipsoideæ, 4 – 5-blastæ, sporoblastis irregularibus subdivisis 1½ – 4-plo diam. longiores. On trunks of elm (*Ulmus Americana*) in the low country of the Santee, South Carolina, *Mr. Ravenel.* In Southern Alabama, *Mr. Beaumont.* Thallus at first appearing in thin, roundish, somewhat powdery patches, but becoming a quarter of a line thick, with a very delicately uneven, as if powdery, at length finely rugulose, or rimulose-verruculose surface, which is beset, more or less thickly, with isidioid, elongated, rarely at length branched excrescences, attaining to more than a line in length; from pale greenish-gray becoming ashy-gray. Apothecia large (the larger ones little less than a line in diameter), innate, urceolate-scutelliform, at length much dilated; the exterior exciple bordering, with an incurved lacerate margin, the black disk, which is covered with a white bloom (becoming thicker, and more crustaceous, when it is broken and perforated, as in *T. schizocarpum*, herein described, and other species), and is seen, in a section, to be enclosed by a pale-brownish line, extending above it into the thalline margin. Interior exciple indistinct. Spores of middling size, dark-brown, from subcocciform becoming ovoid-ellipsoid, and at length rather oblong, or attenuate at one end (dacryoid, *Koerb.*), the length from once and a half to four times exceeding the diameter. Certainly akin to a much smaller southern lichen, which is referred by Dr. Nylander to a variety of his *T. compunctum*. The latter was regarded a species of Urceolaria by Acharius, and the present has much of the same aspect; but it is, I think, inseparable from Thelotrema. Paraphyses indistinct, but apparently filiform.

THELOTREMA LEIOSTOMUM, sp. nov.: thallo tenui effuso lævigato rimuloso-verruculoso glaucescente; apotheciis immersis rotundatis aut confluenti-difformibus (lirelliformibus), excipulo exteriori urceolato margine prominulo integerrimo albido discum nigricantem velo subcrustaceo margini concolore demum perforato vestitum cingente. Sporæ octonæ, fuscæ, ellipsoideæ, demum oblongo-ellipsoideæ, septis 3 sporoblastisque regularibus 4, diam. 2 – 3-plo longiores. Trunks, island of Cuba, *Mr. Wright*. Thallus smooth, glaucescent. Apothecia immersed, minute, rounded, but confluent at length, and passing into irregular, often lirelliform shapes, often approaching a line in length; the exterior exciple bordering the sunken, blackening disk, with a slightly prominent, smooth and entire, white, or pale cream-colored margin; the thickish, smoothish veil, which covers the disk, and becomes at length, in the larger apothecia, perforated, in the manner of *T. Auberianum*, being of the same color with the margin. Spores regularly ellipsoid, brown, with three dissepiments and four regular sporoblasts; the length from twice to thrice exceeding the diameter. Paraphyses filiform, distinct.

THELOTREMA CUBANUM, sp. nov.: thallo effuso tenui lævigato ruguloso rimoso e glauco-virescente pallide luteo-virente; apotheciis majusculis e conico-hemisphærico mox dilatatis scutelliformibus aut difformibus adnatis, excipulo exteriori margine crasso demum fisso-sublobato recurvo albo-velato discum cinereo-nigricantem velo albo subcrustaceo coopertum cingente. Sporæ octonæ, fuscæ, ellipsoideæ, tetrablastæ, sporoblastis dein subdivisis diam. duplo longiores. On trunks, Monte Verde, island of Cuba, *Mr. Wright.* Thallus thin, but at length well developed, becoming wrinkled and chinky, from glaucescent-greenish at length acquiring a pale yellowish tinge. Apothecia soon superficial, and depressed-globular, the sides often gibbously irregular (much as is observable in *Ascidium Cinchonarum*, Fée); the rounded aperture white-edged (such apothecia measuring half a line in diameter), but becoming finally dilated and scutelliform (or variously irregular), and from a line to two lines in the longest diameter; the exterior exciple, which is (in section) black within, bordering with an erectish and rather acute, but at length cleft and recurved, white-veiled margin, a thickish, grayish-black disk, closely covered with a crustaceous, white veil. Spores in eights, brown, short and broad-ellipsoid with rounded tips (cocciform, *Koerb.*), tetrablastish, the flattened sporoblasts at length irregularly subdivided. The thick, smooth veil sometimes assumes the color of the thallus, or is overspread with it; and, more rarely, the thalline exciple in its earlier subglobose condition becomes continuous above, with the whole aspect of Pertusaria, the interior exciple being indicated, here and there, by differently-colored cracks, or these cracks even assuming at length the appearance of ostioles or of young apothecia. And such pertusariiform apothecia appear also to be compound, a cross section showing that the disk is divided more or less by processes from the veil. Compare the anamorphosis of *T. Auberianum*, alluded to by Montagne in Crypt. Guyan. p. 55, as depending on a "hypertrophie des cloisons des excipulum confluents, qui constituent les verrues composées de l'espèce." And what appears a further atypical variation of structure in the same direction, "analogue à l'état varioloide des Pertusaires," is described by the same author in Crypt. Cuba, p. 167.

THELOTREMA AURATUM, sp. nov.: thallo lævigato ruguloso demum verrucoso crasso pallide stramineo; apotheciis majusculis superficialibus subglobosis, apertura rotundata ampla, excipulo exteriori urceolato margine coarctato-incurvo eroso nigro-punctato discum flavo-pruinosum cingente, interiori indistincto. Sporæ octonæ, incolores, obtuse ellipsoideæ vel oblongo-ellipsoideæ, 4–6-blastæ, sporoblastis mox subdivisis diam. 2 – 2½-plo longiores. On trunks, island of Cuba, *Mr. Wright.* Thallus smooth, and at first pretty even, but soon becoming wrinkled, and at length coarsely verrucose, pale straw-colored; the specimens varying from a greenish to an obscurely brownish tint. Apothecia subglobose, oftener a little depressed urceolate, with an ample rounded aperture; the largest exceeding a line in diameter. Exterior exciple including, within a thalline layer (as seen by a section), the black walls of the proper exciple, which disappears or loses its color below (perithecium laterale, *Eschw.*), and is pruinose above, like the disk; the incurved margin being erose, and black-dotted by the protrusion of the edge of the proper exciple. Disk flat, thin, fuscescent, clothed with a bright lemon-yellow bloom; becoming at length brick-colored. Spores in eights, of middling size, colorless, from short-obtuse-ellipsoid (cocciform, *Koerb.*) becoming oblong-ellipsoid, 4 – 6-blastish; the sporoblasts once, or even twice, more or less divided, the length from twice to twice and a half exceeding the width. Paraphyses filiform. The larger apothecia not unfrequently become compound, processes from the walls of the proper exciple dividing it into two or three small ones; and these smaller exciples, which are externally more or less brownish-brick-colored, (a modification of the coloring not uncommonly affecting also the summit of the common margin,) are, of course, entirely free of the thallus, and distinct from it, or, in other words, proper exciples, and perfectly visible. But in the otherwise sufficiently different *T. Auberianum*, Montag. (which Mr. Wright has abundantly collected), as explained by my valued friend, the author of the species, in the place already cited, the thick veil covering the disk conceals its subdivision, though this is seen in a cross-section to accord with the subdivision of the veil; the irregularly-radiate processes into which the latter passes being continued downward, more or less, through the disk.

THELOTREMA WRIGHTII, sp. nov.: thallo crassiusculo fragili lævigato inæquabili glauco-virescente; apotheciis majusculis mox apertis dilatatis subsessilibus scutelliformibus, excipulo exteriori margine elevato pulverulento crasso obtuso carneolo demum flexuoso discum planum pallidum albo-pruinosum cingente veloque pulverulento margini concolore interrupte demum vestiente. Sporæ octonæ, incolores, lato-ellipsoideæ, apicibus acutis demum fusiformi-subelongatæ, 4 – 6-blastæ, sporoblastis inæqualibus subdivisis diam. 2 – 4-plo longiores. Trunks in woods. Monte Verde, island of Cuba, *Mr. Wright.* Thallus thickish, with at length a diameter of a quarter of a line, very brittle, glaucous-greenish. Apothecia soon open, suburceolate, becoming scutelliform, and sessile, or at length often a little elevated, and larger than in any other known species (exceeding two lines in diameter); the exterior exciple bordering with a somewhat elevated, thick, obtuse, powdery, pale-flesh-colored, finally flexuous margin the thin, colorless, white-pruinose disk (seen, by a section, to be included within a fuscescent layer, passing upwards into, and conditioning, the margin), which it also, at length, interruptedly covers with thick processes of the same color and substance as the margin; this development (veil) being, however, less continuous than in other species, and often deficient. Spores colorless, ventricose-ellipsoid with acute tips, or at length longer and rather broad spindle-shaped, 4 – 6-blastish; the sporoblasts unequal in size, and one or more of them finally divided, from twice to four times longer than wide. Paraphyses filiform, rather distinct. What is above described as the veil appears to be analogous to what Montagne (sub *T. Auberiano*, Cuba, l. c.) has called by the same name; this being understood by him as indicating an extraordinary condition of the interior exciple. But in the species before us this veil appears rather to be a result of a *nisus* of the proper exciple (which I understand as concrete with, or making the inner wall of, the exterior exciple) to become compound, exactly as in *T. auratum;* the processes which make it up being evidently similar in all respects to the inner wall, and their color conditioned, in both the species mentioned, by the color of that. It cannot, therefore, if these observations are correct, correspond with the interior exciple of *T. lepadinum*, which must be regarded as deficient in these species, or only represented by the bloom of the disk.

THELOTREMA GLOBULARE, sp. nov.: thallo cartilagineo-membranaceo lævigato e glaucescente pallide fuscescente, hypothallo nigro-limitato; apotheciis submediocribus superficialibus depresso-globosis urceolatis excipulo exteriori margine obtuso aperturam impressam poriformem cingente, disco plano-concavo pallido subvelato. Sporæ octonæ in thecis lineari-clavatis, incolores, obtuse ellipsoideæ vel oblongæ, tetrablastæ; sporoblastis regularibus diam. $1\frac{1}{2} - 2\frac{1}{2}$-plo longiores. Trunks, in the island of Cuba, *Mr. Wright.* Thallus thin, but well-developed, smooth, from glaucescent becoming very pale brownish, bordered, often conspicuously, by the black edge of the hypothallus. Apothecia of the color of the thallus, becoming whiter above, a few of the larger ones half a line in diameter, depressed-globular, the base becoming inflexed; an urceolate outer exciple bordering with an obtuse, smooth, or at length radiate-striate margin an impressed, rounded, and pore-like aperture. Disk not visible until exposed by the knife, a little concave, pale within, more or less white-veiled; a section showing it to be included within a brown line, which extends upwards into the exterior exciple. Spores at length broad-oblong, colorless, from diblastish becoming regularly tetrablastish; the sporoblasts, or at least the middle ones, flattened; from once and a half to twice and a half longer than wide. Paraphyses filiform. A neat and distinct Thelotrema, which I cannot refer to any published species. *T. urceolare* Ach. Syn. p. 115, as described, appears in some respects similar, but the spores, according to Nylander, (Lich. exot. in Ann. Sci. 4, 11, p. 222,) are brown and murally divided.

THELOTREMA ACTINOTUM, sp. nov.: thallo effuso membranaceo glaucescente mox granulato, granulis minutis demum congestis cæsio-nigricantibus; apotheciis majusculis scutelliformibus sessilibus subplanis, excipulo exteriori margine crassiusculo obtuso albicante discum nigricantem velo margini concolore radiatim perforato vestitum cingente. Sporæ parvæ, incolores ex ellipsoideo subfusiformes, tetrablastæ, diam. 2½ – 4-plo longiores. On trunks, incrusting small ferns and mosses, Monte Verde, island of Cuba, *Mr. Wright.* Thallus very thin, glaucescent, at length besprinkled with minute granules, which become heaped, and grayish-black. Apothecia large, often a line in diameter; scutelliform, adnate, flat; a rather thick and entire, white, outer margin bordering a thin, pale disk, which blackens above, and is veiled by processes from the inside of the margin, which meet in the centre, from which they appear to radiate. Spores small, colorless, tetrablastish. Paraphyses filiform, distinct. In this species, which is strikingly Lecanorine in aspect, the veil, as in the last species, appears to be made up of processes from the inner side of the outer exciple, and, as in that, to indicate the otherwise evident tendency of the Thelotremaceous apothecium to develop, atypically, into a composite one; sometimes curiously suggestive of that of Pertusaria.

THELOTREMA SCHIZOSTOMUM, sp. nov.: thallo tenui lævigato inæquabili e glauco-viridulo lutescente, hypothallo nigricante sublimitato; apotheciis mediocribus innato-prominulis demum dilatatis e rotundato difformibus, excipulo exteriori erectiusculo mox fisso recurvo discum planum pallidum albo-pruinosum vel velatum cingente. Sporæ suboctonæ, incolores, fusiformes, 4 – 10-blastæ, diam. 4 – 8-plo longiores. On trunks, Monte Verde, island of Cuba, *Mr. Wright.* Thallus thin, but well-developed, smooth, from glaucescent-greenish becoming somewhat obscurely yellowish-green, limited more or less by the blackening hypothallus. Apothecia from a quarter reaching sometimes three quarters of a line in diameter, innate, or at length a little prominent, dilated, from roundish becoming irregular; the cleft and recurved margin, which is white-powdery within, and flecked more or less on the torn edges with brown, from the protrusion of the interior layer, bordering a thin, pale, white-pruinose disk, sometimes at length veiled irregularly, in the manner of the last species and *T. Auberianum.* Spores colorless, fusiform. Paraphyses filiform, conglutinate. In some species which possess a distinct interior exciple (as *T. lepadodes* and *T. albilabrum*, described here) this is sometimes obscure, as if deliquescent and confluent with the powder of the disk; and it would not be difficult, on the other hand, to describe (or misdescribe) some younger apothecia of the present as clothed with a delicate, or deliquescent, white, interior exciple, bursting in the manner of the other species cited; though there is no trace of anything but the bloom, divided, more or less, by somewhat radiant cracks, in the older ones. These older apothecia are, at length, as already observed, closed more or less by a thicker, subperforate vesture, due in part, it should seem, to a mere thickening of the powder of the disk, but accompanied also with the extension of processes from the inside of the outer exciple, or, in other words, finally confluent with the latter.

THELOTREMA MYRIOPORUM, sp. nov.: thallo tenui subcartilagineo verruculoso dein æquabili lævigato subpruinoso glaucescente; apotheciis minutis immersis rotundatis apertis vel sparsis vel in series confluenti-difformes aggregatis cribroso-pertusis; excipulo exteriori urceolato margine demum subprominulo discum plano-concavum pallidum subvelatum cingente. Sporæ octonæ, parvulæ, incolores, ellipsoideæ, regulariter diblastæ, diam. 1½ – 2½ longiores. On trunks of various trees, Monte Verde, island of Cuba, *Mr. Wright.* Thallus thin, but rather firm, at first finely warted, but becoming even, glaucescent, dull, or even obscurely pruinose, pierced thickly with the minute rounded aperture of the very numerous apothecia, which are either scattered, or disposed in irregular, confluent groups; these apertures being either even with the thallus, or this last a little raised at their edges, or even at length making a slightly prominent, very entire margin; the white proper exciple more or less apparent within. Disk a little concave, pale, clothed at length with a white, perforated, irregular veil, in the manner of many other species. Spores small, colorless, ellipsoid, regularly and constantly diblastish; the two opposite, conoidal sporoblasts being separated by a (not always visible) thin dissepiment; the length from once and a half to twice, or even twice and a half, exceeding the width. Paraphyses conglutinate. The only described species of Thelotrema with diblastish spores. Though the habit of the lichen is sufficiently peculiar, and the little group to which it belongs (Myriotrema, Fée, Ess. p. 103, t. 1, f. 25; and Suppl. p. 92, t. 41, f. 1 – 3) is distinguished also by the small size of its colorless spores, there seems to be no good reason (as compare Montagne, Pl. Cell. Exot. in Ann. Sci. 3, 10, p. 131) for distinguishing it.

GYALECTA, Ach. It was remarked by Mr. Turner, in describing his *Parmelia carneo-lutea* (Linn. Trans. 9, p. 145), the apothecia of which, he well says, "are very different from those of any other Parmelia, and more resemble the apothecia of *Urceolaria exanthematica*," that its place in the system "is that immediately following *P. rubra*." But it was not till 1852 that the two last-named species were brought together in the same genus (*Gyalecta*, Massal. Ricerch. p. 146), nor till 1857 that *G. carneo-lutea* (*Lecidea* § *Gyalecta*, Nyl. Prodr. Gall. p. 101, n.) was added to them. The group is an exceedingly difficult one; but the remark may be ventured, that however some species, scarcely to be excluded from it, appear to pass into Lecidea, others are conditioned by the thallus, or by other elements, in a way quite alien to Lecidea; while these differing subsections show obvious points of agreement in the internal details of their fructification. The relation of *G. rubra* to *G. foveolaris*, &c., is illustrated by Th. Fries in Lich. Arct. p. 138. Acharius's type of Gyalecta (Lich. Univ. p. 29, t. 1, f. 7) was *G. epulotica*, since understood differently by Fries and later writers; but Nylander (Lich. Scand. p. 189) adds this little-known lichen (of which a fine specimen from Mr. v. Krempelhüber is before me), together with the nearly akin *G. Prevostii*, Fr., with apparently full reason, to his section Gyalecta, — from the other species composing which the two spoken of especially differ in their simple spores. The contrast between such spores and the tetrablastish, and finally pleioblastish spores, which have been understood as characteristic of Gyalecta, is however lessened by the intermediate differentiation of the spores of *G. asteria*, described below; and the genus, in this respect, as well as in the variously modified external characters and habit of the apothecia, may be considered as analogous to Thelotrema, as here taken.

GYALECTA ASTERIA, sp. nov.: thallo contiguo rimoso dein granuloso-verruculoso glaucescente; apotheciis minutis superficialibus depresso-globosis thallo adscendente subvestitis, excipulo connivente radiato-rugoso albido-carneolo demum denudato nigricante poriformi-aperto discum subnucleiformem incolorem fovente. Thecæ elongatæ, subcylindraceo-clavatæ, polysporæ. Sporæ parvulæ incolores ex ovoideo ellipsoideæ regulariter dyblastæ diam. 1½ – 2½-plo longiores. On shrubs, Santiago, island of Cuba, *Mr. Wright.* Thallus well developed, becoming granulose-verruculose, glaucescent; the sometimes radiant hypothallus from white becoming brownish at the edge. Apothecia minute, superficial, globular, clothed more or less by the thallus, a pale flesh-colored proper exciple, which is connivent and radiately notched above, opening by a pore-like aperture, and enclosing a nucleiform colorless disk. With age the exciple becomes denudate above and brownish-black, which is seen, in section, to be the color of the whole interior portion. Spore-sacks poly- (12 – 20-) sporous. Spores small, colorless, simple at first, but becoming regularly diblastish; the outline varying from ovoid to ellipsoid, and the length from once and a half to twice and a half exceeding the width. Nearest, in aspect, to the following species; but remarkably distinguished by its blackish exciple, the color of which is concealed below by the ascending thallus, and above by a paler vestiture, which is cleft, pretty regularly, into portions appearing to radiate from the pore-like aperture; also by the spores.

GYALECTA ABSCONSA, sp. nov.: thallo tenuissimo leproso albido; apotheciis minutis mox superficialibus thallo vestitis excipulo urceolato carneo-rubello margine incurvo radiato-crenato discum pallidum cingente. Thecæ subcylindraceæ, octosporæ. Sporæ incolores, primo ellipsoideæ, diblastæ, dein lato-fusiformes, tetrablastæ, septis vix irregularibus, diam. 2½ – 3½-plo longiores. On trunks of red maple, in the low country of South Carolina, accompanying *Arthonia spectabilis*, Flot.; *Mr. Ravenel.* Near to *G. abstrusa* (Wallr.), Arn. (*G. Wahlenbergiana*, var. *truncigena*, Ach.), and the apothecia of about the same size, but more prominent, less open, and higher-colored, with a whitish (pruinose ?) disk, and, except the radiately-cleft margin, always loosely clothed by the thallus. The spores of *G. abstrusa* (Herb. Borr.; Zw. Exs. n. 80) are not unlike those of *G. cupularis*, having an equally irregular internal configuration; and contrast with the shorter, quite uniformly thrice-septate spores of the present. The spaces between the sporoblasts which represent dissepiments in spores of this kind, are commonly (as in other species) not quite straight. The sporoblasts are sometimes arranged more loosely, with wider interspaces; but no indication has appeared of a passage into the spores of *G. abstrusa.* — The last-mentioned lichen appears (by the citations of the German writers, the original description being perhaps hardly sufficient) to have been first recognized as a species by Wallroth (Fl. Crypt. Germ. 1, p. 38), and, this being so, should bear the name which he gave it. The fact that Acharius called the same plant *G. Wahlenbergiana*, var. *truncigena*, can give no precedence to the later specific name, *Gyalecta* or *Lecidea truncigena*, because the Acharian designation expressly asserts the exact opposite to the latter, namely, that the plant, instead of being a new, is an old species. And, if this opinion is not mistaken, we may venture to say generally, what there are some reasons for saying, that the name which may happen to be given to a variety has no precedence, but may be adopted, or not, if the plant is taken up as a species.

GYALECTA NANA, sp. nov.: thallo tenuissimo leproso albido vel obsolescente; apotheciis minutissimis innato-emergentibus subplanis, excipulo pallido integro ab exteriore thallode lacero-dehiscente evanido primitus velato discum carneo-fuscescentem cingente. Thecæ subclavatæ, 8 – 12-sporæ. Sporæ parvulæ, incolores, ex ellipsoideo dactyloideæ vel subfusiformes, tetrablastæ, diam. 3 – 5-plo longiores. Thallus obscure or deficient. The very minute apothecia (scarcely more than half the size of those of *L. abstrusa*) are flattish, with much the aspect of those of *G. carneo-lutea* (Turn.), and similarly at first innate and afterwards emergent; the here entire, pale proper exciple being covered at first by a dehiscent and soon disappearing outer veil. Disk pale brownish-flesh-colored, for the most part exceeded by the margin, easily falling out, as in other species. Paraphyses filiform, flexuous, the summit thickened into a small head. Spore-sacks rather club-shaped, commonly 10 – 12-sporous. Spores small, colorless, from ellipsoid becoming dactyloid or subfusiform; and from diblastish at length regularly tetrablastish; for the most part four, more rarely five times longer than wide. The similar spores of *G. carneo-lutea* (Herb. Borr.; Welwitsch, Crypt. Lusit. n. 67) are at length regularly 6-blastish.

GYALECTA CERATINA, sp. nov.: thallo subobsoleto; apotheciis minutis sessilibus concavis e fusco-rufo nigricantibus, margine subintegro discum concolorem cingente. Thecæ clavato-cylindraceæ, octosporæ. Sporæ incolores, parvulæ, cymbiformes vel subfusiformes, 4 – 8-blastæ, sporoblastis subregularibus, diam. 3 – 5-plo longiores. Trunks of elms and ashes, Massachusetts. Perhaps not rare, but easily passed over, though the apothecia are visible to the naked eye. The lichen is externally exceedingly like *G. cornea* (*Lecidea carneola*, Auct.), and long passed for it in my herbarium; but it is darker, and the spores are different. These, in our American lichen, are at first exactly cymbiform, with three to four regular sporoblasts, and about twice and a half longer than wide; but the tips are often acuminated, and the spore becomes at length more spindle-shaped, with four to eight sporoblasts, and from four to five or even six times longer than wide: while in *G. cornea* (Herb. Borr.; Nyl. Lich. Par. n. 132; Rabenhorst, Lich. Eur. n. 445) we have constantly acicular, plurilocular spores, with from twelve to twenty sporoblasts, and as many times longer than wide. *L. cornea* has been regarded by almost all lichenists as belonging to Lecidea; but Mr. Borrer considered it, in 1842, nearly related to Gyalecta; and Dr. Nylander, in his later works, places it with the same group, considered by him as making the first section of Lecidea. Paraphyses not unlike those of the preceding species.

Cœnogonium moniliforme, sp. nov.: thallo effuso margine laxiori pallidiori sublimitato e filamentis breviusculis gracillimis articulis ad septum constrictis mox subglobosis centro crustaceo-agglomeratis e glauco-viridi fulvescentibus; apotheciis appressis subplanis, excipulo cupulari discum carneolo-rubellum margine albo cingente. Sporæ octonæ in thecis lineari-clavatis, incolores, oblongæ, diblastæ, diam. 3 – 4-plo longiores. On trunks, in the island of Cuba, *Mr. Wright.* Thallus effuse, more crust-like than in other species, made up of short moniliform filaments; the joints, by constriction at the dissepiments, becoming more or less rounded, from glaucous-green at length tawny-brown; the margin of the fronds a little paler. Apothecia quite those of the genus. Spore-sacks clubshaped; the eight spores disposed, now in a single, and now rather in a double series. Spores oblong-ellipsoid, or somewhat fusiform-ellipsoid, scarcely as long as those of *C. confervoides*, Nyl. (to which, described in Lich. Exot. l. c. p. 242, I refer a Cuba lichen collected by Mr. Wright), typically septate-diblastish. Paraphyses aciculiform, as in all the species. Beside *C. confervoides*, extending northward as far as Louisiana, and approaching near to, though it appears distinct from, *C. Linkii*, upon which Ehrenberg constituted the genus, Dr. Nylander has described another (*C. complexum*, Lich. Exot. l. c. p. 222), with shorter, coarser, *tomentose* filaments, larger apothecia, and diblastish spores, which (first collected in Bolivia by Weddell, and since in Venezuela by *Mr. Fendler*) has not yet occurred in the Cuba collections. The apothecia of *Cœnogonium* especially resemble those of *Gyalecta* (or *Lecidea*) *lutea;* as if the former were, in fact, to use Fries's words (S. O. V. p. 301), "Biatora in thallo Byssaceo." But the supposed collemaceous structure appears not to be made out, and the plants are perhaps therefore better taken, as by Nylander (comp. Enum. Gen. p. 140, note) as expressing an aberrant type of the *Lecideei.*

LECIDEA (PSORA) RUSSELLII, sp. nov.: thalli squamis crassis lævigatis subimbricatis undulato-lobatis e pallide viridi rufescentibus subtus margineque albis; apotheciis sessilibus, margine obtuso flexuoso rufo discum e subconcolore viridi-nigrescentem demum tumidulum cingente. Sporæ incolores, ellipsoideæ, limbatæ, diam. 2 – 2½-plo longiores. On lime-rocks, Burlington, Vermont, *Mr. Russell;* and at Brattleborough, on schist, *Mr. Frost.* Northward, at Behring's Straits, *Mr. Wright.* Frederick County, Maryland, on lime-rocks. Alabama, on the same rocks, *Mr. Peters.* Texas, (on the earth, and in crevices of lime-rocks near the Blanco,) *Mr. Wright.* Jurassic rocks, head of Powder River, Rocky Mountains, *Dr. Hayden.* Scales at first closely appressed, smooth, from pale-greenish becoming brownish, and at length reddish-brown; the ascending white-powdery margins waved and sinuously lobed; white beneath. Apothecia middling-sized or largish, sessile; the thick, reddish-brown, shining, at length flexuous margin (which becomes sometimes paler, or white-powdery) finally excluded by the convex, rufous, at length greenish-nigrescent disk. Rather resembling *L. testacea* than *L. globifera;* but the colors appear to distinguish it. The lichen has also much of the aspect of fine specimens of *Lecanora cervina, α, glaucocarpa.* The disk is pale-brownish within, and rests upon a pale hypothecium. — The genus Biatora, in the sense of Fries, much as its separation facilitated the study of an obscure tribe, appears hardly maintainable, otherwise than as a section of Lecidea; and that part of it to which the present and next-following species belong (*Psora*, Massal.), though obviously analogous to the squamulose Lecanorei (*Squamaria* and *Placodium*, DC., Nyl., *Placodium*, Auct.) is by no means so easily to be distinguished. The spores furnish an elegant criterion of the affinity of species, but the significance and value of the sporal differentiation seem not yet sufficiently well understood to make this a safe guide, or, at least, more than a guide, in the distinction of genera; as it surely is an insufficient ground, in the case of such constructions as *Synechoblastus*, Trevis., and *Menegazzia*, *Ochrolechia*, *Secoliga*, Massal., &c. And this opinion, which, it is proper to say, has resulted from the description and preparation for publication of more than ninety North American, beside numerous other species referable to Lecidea, as understood by Acharius, during which constant use has been made of the instructive works of Koerber, as well as of the earlier writers of the same school, is in accordance with, as it was first suggested by, the only universal system of Lichenes of the present day, — that of the learned Dr. Nylander. This species, which is perhaps the finest representative of Lecidea known to North America, is dedicated to our colleague, my valued friend and fellow-student of the Lichenes, the Rev. John Lewis Russell.

LECIDEA (PSORA) LURIDELLA, sp. nov.: thallo squamoso imbricato e viridi-cervino fuscescente, squamis parvulis appressis lævigatis subcrenatis; apotheciis adnatis convexis immarginatis rufo-nigris. Sporæ octonæ, parvulæ, incolores, ovoideæ et oblongo-ovoideæ, protopl. in guttulas secedente, diam. 1½ – 2-plo longiores. On the earth. Mountains of Santa Fe, New Mexico, *Mr. Fendler*. On the Snake Fork of the Columbia River, in the Rocky Mountains, alt. 6,000 ft., *Dr. Hayden*. Scales of the thallus much smaller, and also thinner, than those of *L. lurida* and *L. globifera*, the nearest allied species, from roundish becoming oblong, appressed, but the edges free, and at length a little elevated, crenate, or even obscurely lobed, or also reduced and glebulose, from pale-brownish with a greenish tinge when wet becoming tawny-brown. Apothecia small, adnate, convex and apparently immarginate from the first, finally subglobose, from blackish-rufous at length black. This little lichen (of which more than fifty excellent specimens are before me) appears to approach nearest to *L. lurida* in coloration, the thallus never showing the ferruginous tinge of *L. globifera*, and in the more appressed scales; and to *L. globifera* in the convex, subimmarginate, at length a little elevated fruit. I have sought in vain for any clear trace of a margin. The spores scarcely furnish distinctive characters in the present group (*Psora*, Massal.): but those of the lichen in hand perhaps agree rather with those of *L. lurida*, both in shape, and in the variableness of the sporoblast (a feature taken into his specific character of the just-mentioned species by Dr. Koerber), though they are smaller. In one of the specimens from New Mexico the scales are white-pruinose.

LECIDEA (BIATORA) PYRRHOMELÆNA. *Biatora*, Tuckerm., Suppl. l. c. Trunks, in the island of Cuba, *Mr. Wright.*

LECIDEA (BIATORA) PHÆASPIS. *Biatora*, Tuckerm., Suppl. l. c. With the last.

LECIDEA (BIATORA) VIRELLA. *Biatora*, Tuckerm., Suppl. l. c. With the last.

LECIDEA (BIATORA) MELAMPEPLA, sp. nov.: thallo leproso-tartareo diffracto-rimoso ferrugineo-fuscescente, hypothallo nigricante; apotheciis submediocribus appressis e plano tumidulis intus incoloribus, disco nigro primitus albo-pruinoso margine crassiusculo pallidiore demum concolore cincto. Sporæ fusiformi-oblongæ, subincurvæ, diblastæ, diam. 3 – 5-plo longiores. On shrubs; hills near Simon's Town, Cape of Good Hope (U. S. N. Pacific Expl. Exp.), *Mr. Wright.* Thallus making small roundish patches, from scurfy at length compacted and chinky, rusty-brown, rarely black-bordered by the hypothallus. Apothecia grouped somewhat concentrically, almost middling-sized or smallish (the larger ones from a third reaching rarely half a line in diameter), appressed; a thickish, pale, biatorine exciple bordering a black, originally white-pruinose, flat, or at length rather tumid disk (which is colorless within), and becoming finally of the same color with it. Spores in clubshaped spore-sacks, small, colorless, from oblong-ellipsoid becoming fusiform-oblong, often very slightly or scarcely bent, diblastish; the length from thrice to five times exceeding the diameter. Paraphyses conglutinate. Near to *L. mixta* (Fr. Lich. Suec. n. 40), of which Mr. Wright collected excellent specimens at the Cape of Good Hope, but very distinct in its rusty-brown, subtartareous thallus, and larger apothecia. *Biatorina*, Massal. (Ric. p. 134, Koerb. Syst. p. 189, to which the present lichen is referable), however unavoidable a part of the system to which it belongs, appears none the less a forced association of forms, of distinct and sometimes even remote affinities, held together by nothing but the diblastish differentiation of the spores.

LECIDEA (BIATORA) CHLOROSTICTA, Tuckerm. Lich. exs. n. 139: thallo effuso e granulis subsparsis rotundatis lævigatis viridi-glaucescentibus; apotheciis minutis sessilibus primitus convexis subimmarginatis e livido nigris nitidis dein turgidulis papillatis, hypothecio nigricante. Sporæ suboctonæ, incolores, aciculares, di – tetrablastæ, diam. 6 – 12-plo longiores. On trunks of white cedar (Cupressus thyoides) in Hingham, Massachusetts. On pine and cypress trunks; low country of South Carolina, *Mr. Ravenel.* Thallus of rounded, smooth, commonly scattered, greenish-glaucescent granules. Apothecia minute, convex and subimmarginate from the first; sessile or at length a little elevated; the black and shining disk finally turgid and papillate, and imposed upon a black hypothecium. Spores small, from broad-spindle-shaped with acuminate tips becoming more elongated, and at length clubshaped or acicular, commonly diblastish, but at length tetrablastish; the length from six to twelve or even sixteen times exceeding the diameter. Belonging to the group of which *L. rubella* is a type (*Bacidia*, De Not.); but the black apothecia and sometimes slightly curved spores rather approach those of *L. holomelæna*, Floerk. (*Scoliciosporum*, Massal., only differing from Bacidia in the contortion of the spores), not uncommonly occurring on granitic stones, and, in another form (*L. asserculorum*, Ach.) on old rails.

LECIDEA GRANOSA, sp. nov.: thalli effusi granulis minutis congestis vel confluentibus e viridulo cinerascentibus; apotheciis minutis appressis plano-convexulis, disco nigro (livido-pallescente) marginem tenuissimum nigrum demum excludente. Sporæ octonæ, incolores, e dactyloideo subbacillares, di – tetrablastæ, diam. 3 – 6-plo longiores. On brick walls, near New Orleans, *Dr. Hale.* On bricks, and also on mortar, in the low country of South Carolina, *Mr. Ravenel.* Thallus of very minute granules, which are heaped, more or less densely, into an irregular, broken crust, or occur more scattered and inconspicuous, or grow together into a thin, chinky one, from greenish becoming at length glaucescent or cinerascent. Apothecia very small, closely appressed (or even immixt) and flat; the black (or livid-pallescent) disk bordered by a thin black margin, which disappears as the disk finally becomes a little convex. Hypothecium black. Spores varying no little, colorless, from ellipsoid soon elongated and narrowed, and from dactyloid or often clubshaped becoming cylindraceous or staff-shaped; perhaps more commonly diblastish, but also and often regularly tetrablastish (regular 5-blastish spores occur rarely, but no regular ones have been observed with a greater number of sporoblasts), the length from three to six or even seven times longer than wide. Paraphyses not distinct. A smaller lichen, in all respects, than *L. aromatica* (Sm.) Ach. (Herb. Borr.; Desmaz. in Herb. Ravenel; Herb. Krempelh.) with slenderer spores.

LECIDEA SIMODENSIS, sp. nov.: thallo primitus contiguo subtartareo mox diffracto verrucoso albicante; apotheciis mediocribus sessilibus nigris, disco aterrimo demum convexo margine obtuso tenuescente. Sporæ octonæ in thecis clavatis, parvulæ, incolores, oblongæ, diblastæ, diam. 2 – 3-plo longiores. Maritime rocks, Simoda, Japan (U. S. North Pacific. Expl. Exp.), *Mr. Wright.* Thallus thickish, apparently at first contiguous, but in the specimen much broken and warted, whitish. Hypothallus appearing bluish-black at one point of the circumference. Apothecia from the thallus, middling-sized, thickish, at length convex-protuberant; the obtuse shining margin finally much excluded by the swelling very black disk, which appears, in section, brownish-violet within; the hypothecium being of this color, especially above, and tinging the hymenium. Spores small, oblong, often slightly oblique (fabæform), regularly diblastish, the sporoblasts tinged obscurely yellowish, from twice to thrice longer than wide. The lichen, of which but a single specimen was collected, has much the aspect of *L. contigua convexa* (Fr. Lich. Suec. n. 378); but the spores connect it with *L. grossa*, Nyl. (*L. premnea*, Fr. Lich. Suec. n. 26; Borr. herb.), which has a different thallus, and is confined to trunks. The spores of *L. grossa* are larger than those of the present, and blunt-ellipsoid; while those of *L. Simodensis* are often not ill represented by Dr. Koerber's figure of the spores of Ramalina (Syst. t. 2, f. 10). *Catillaria*, Massal. (Ric. p. 79), to which both these lichens are referable (*L. grossa* being regarded as the type of the genus by Koerber), is admitted to be a more than commonly difficult construction; but the type at least is perhaps easily considerable as a colorless expression of *Buellia*, De Not. The last-named group appears better defined; but, considered as a genus, its relations with *Rhizocarpon*, Massal. (as see especially Th. Fries, Lich. Arct. p. 226) are sufficiently puzzling.

LECIDEA JAPONICA, sp. nov.: thallo effuso e granulis minutis applanatis sublobatis squamuloso-imbricatulis viridi-fuscescentibus (lutescentibus); apotheciis parvulis appressis nigris, margine tenui distincto discum plano-convexum scabridum demum hemisphæricum hypothecio nigro impositum cingente. Sporæ octonæ in thecis clavatis, mediocres, fuscescentes, ellipsoideæ, uniseptatæ, sporoblastis isthmo junctis, diam. 2½-plo longiores. On bark of Cryptomeria, Simoda, Japan (U. S. N. Pacif. Expl. Exp.), *Mr. Wright.* Thallus of minute, confluent, lobed and scale-like, somewhat imbricated, brownish-green, or also obscurely yellowish, granules; which are confused with the hypothallus. Apothecia smallish, at first flattish; a thin, distinct, or even slightly prominent, minutely rugulose margin bordering the soon convex and at length hemispherical, scabrous disk; which is white within, and rests on a thick black hypothecium. Spores middling-sized, rather pale-fuscescent, pretty regularly ellipsoid; the two sporoblasts soon flattened or as if halved, and constantly joined by a stout isthmus, which is crossed by the well-defined dissepiment. Of the same group with *L. myriocarpa*, DC., Nyl. (*L. chloropolia*, Fr.); but strikingly distinct in the development and color of the thallus, the larger apothecia, and much larger spores, in which the isthmus, often observable (as a transient feature, Koerb. Syst. p. 436) in spores of this type (*Buellia*, De Not.) appears to be constant.

Professor Lovering and Dr. M. Wyman supported the opinion of the majority of the Rumford Committee, that it is not advisable to award the Rumford Medal to Mr. Ericsson for improvements in the hot-air engine.

Professor Horsford, in reply, further supported the claims of Mr. Ericsson.

Five hundred and eighth meeting.

May 13, 1862. — MONTHLY MEETING.

The PRESIDENT in the chair.

Professor Peirce presented, in behalf of the author, a paper On Certain Forms of Interpolation, by W. P. G. Bartlett.

Professor Lovering and Professor Winlock, on the one side, and Professor Horsford on the other, continued the discussion upon the merits of hot-air engines, with especial reference to that of Mr. Ericsson, and to the majority and minority reports of the Rumford Committee upon the subject.

Remarks relative to the course proper to be pursued by the Academy in this regard were made by Messrs. Washburn, C. Pickering, Agassiz, Peirce, A. Gray, and the President. And the further consideration of the subject was postponed to the Annual Meeting ensuing.

DONATIONS TO THE LIBRARY,

FROM MAY 28, 1861, TO MAY 20, 1862.

Académie des Sciences de l'Institut Impériale de France.

Comptes Rendus. Tom. LII., LIII., LIV. Nos. 1–15. 4to. Paris. 1860–62.

Société Impériale Zoölogique d'Acclimatation.

Bulletin. Tom. VIII., IX. Nos. 1, 2. 8vo. Paris. 1861–62.

Smithsonian Institution.

Smithsonian Contributions to Knowledge. Vol. XII. 4to. Washington. 1860.

Academy of Natural Sciences, Philadelphia.

Journal. New Series. Vol. V. Part I. 4to. Philadelphia. 1862.

Proceedings. Vol. XIII., XIV. Nos. 1, 2. 8vo. Philadelphia. 1861–62.

American Philosophical Society.

Proceedings. Vol. VIII. Nos. 65, 66. 8vo. Philadelphia. 1861.

Prof. E. N. Horsford.

The Theory and Art of Bread-making. A New Process without the Use of Ferment. 16mo pamph. Cambridge. 1861.

Report on Mystic Pond Water to the Boston Harbor Commission. 8vo pamph. Boston. 1861.

Royal Institution of Great Britain.

Notices of the Proceedings at the Meetings of the Members. Vol. III. Part XI. 1860–61. 8vo. London.

List of the Members, Officers, &c., with the Report of the Visitors for the Year 1860. 8vo. London. 1860.

Weekly Evening Meeting, Friday, March 22, 1861. On the Origin of the Parallel Roads of Lochaber (Glenroy), Scotland. 8vo pamph. London. 1861.

Royal Irish Academy.

Transactions. Vol. XXIV. Part I. (Science.) 4to. Dublin. 1860.

Entomological Society, Philadelphia.

Proceedings. March, April, May, 1861. 8vo pamph. Philadelphia. 1861.

Mercantile Library Association of the City of New York.

Fortieth Annual Report. May, 1861. 8vo pamph. New York. 1861.

J. W. Dawson, LL. D., etc.

On the Pre-Carboniferous Flora of New Brunswick, Maine, and Eastern Canada. [From Canadian Naturalist for May, 1861.] 8vo pamph. Montreal. 1861.

On the Vegetable Structures in Coal. [From Quart. Jour. of Geol. Soc., Feb. 1860.] 8vo pamph. London.

On the Silurian and Devonian Rocks. [Comm. to Nat. Hist. Soc. of Montreal.] 8vo pamph. Montreal.

On the Microscopic Structure of some Canadian Limestones. [Extr. from the Canadian Naturalist.] 8vo pamph. Montreal.

Notice of Tertiary Fossils from Labrador, Maine, &c., and Remarks on the Climate of Canada, in the newer Pliocene or Pleistocene Period. 8vo pamph. Montreal.

Notes on the Coal Field of Pictou. By H. Poole, Esq., Supt. of the Fraser Mine. [Comm. to Nat. Hist. Soc. by Dr. Dawson.] 8vo pamph. Montreal.

Catalogue of Canadian Plants in the Holmes Herbarium, in the Cabinet of the University of McGill College. Prepared by the late Prof. James Barnston. 8vo pamph. Montreal. 1859.

Acadian Geology: an Account of the Geological Structure and Mineral Resources of Nova Scotia, &c. 8vo. Edinburgh. 1855.

Royal Bohemian Society of Sciences.

Sitzungsberichte. Jahrgang 1859, Jan. – Juni, July – Dec., 1860, Jan. – Juni. 8vo. Prag. 1859 – 60.

Justin Roblin.

Explication du Zodiaque de Denderah des Pyramides et de la Genèse. Dediée a tous les Chefs d'Etats. 8vo pamph. Caen. 1861.

American Association for the Advancement of Science.

Proceedings of the Fourteenth Meeting, held at Newport, Rhode Island, August, 1860. 8vo. Cambridge. 1861.

American Oriental Society.

Journal. Vol. VII. No. 1. 8vo. New Haven. 1861.

Société Geographique, Paris.

Bulletin. 4^{me} Serie, Tome XX; 5^{me} Serie, Tome I. 8vo. Paris. 1860 – 61.

Listes des Membres de la Société, des Présidents Honoraires, etc. Suivies d'un Extrait des Règlements et de la Liste des Ouvrages publiées par la Société. 8vo pamph. Paris. 1861.

Royal Society of London.

Philosophical Transactions for the Year 1860. Vol. L. 4to. London. 1861.

Proceedings. Vol. XI. Nos. 43–46. 8vo. London. 1861.

List of Fellows. Nov. 30, 1860. 4to pamph. London.

Astronomical and Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the Year 1859. 4to. London. 1861.

Geological Society.

Quarterly Journal. Vol. XVII. Nos. 67, 68. 8vo. London. 1861.

Zoölogical Society, Frankfort.

Zoologische Garten, Organ für die Zoologische Gesellschaft. II. Jahr. Nr. 1–13. 8vo. Frankfurt a. M. 1860–61.

Royal Society of Sciences, Göttingen.

Abhandlungen. Neunter Band. 1860. 4to. Göttingen. 1861.

Nachrichten von der Georg-Augusts-Universität und der Kön. Gesell. der Wissenschaften zu Göttingen, vom Jahre 1860–61. 16mo. Göttingen. 1861–62.

Observatory of Cambridge.

Astronomical Observations made at the Observatory of Cambridge, by the Rev. James Challis, M. A., etc. Vol. XIX. For the Years 1852, 1853, 1854. 4to. Cambridge. 1861.

Royal Bavarian Academy of Sciences.

Abhandlungen der Philos.-Philol. Classe der Königl. Bayerisch. Akad. der Wissenschaften. Band IX. Abth. 2. — Math.-Physik-Classe. Band IX. Abth. 1. 4to. München. 1861.

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Gelehrte Anzeigen. Band. 49 und 50. 4to. München. 1859–60.

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Verzeichniss der Mitglieder der Akad. 1860. 4to pamph. München. 1860.

Rede in der Oeffentlichen Sitzung der k. b. Akademie der Wissenschaften am 28 März, 1860, zur Feier ihres Einhundert und ersten Stiftungstages gehalten von Justus Freidherrn von Liebig. 4to pamph. München. 1860.

Einleitende Worte zur Feier des Allerhöchsten Geburtsfestes Sr.

Majestät des Königs Maximilian II. gesprochen am 28 Nov. 1860, von Justus Freiherrn von Liebig. 4to pamph. München. 1860.

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Rede auf Sir Thomas Babington Macaulay, den Essayisten und Geschichtschreiber Englands. Vorgetragen .... am 28 März, 1860, von Dr. Georg Thomas von Rudhart. 4to pamph. München. 1860.

Von der Bedeutung der Sankritstudien für die Griechische Philologie. Festrede gehalten...... am 28 März, 1860, von Dr. Wilhelm Christ. 4to pamph. München. 1860.

Denkrede auf Alexander von Humboldt. Gelesen ..... am 28 März, 1860, von Carl. Fried. Phil. von Martius. 4to pamph. München. 1860.

Gedachtnissrede auf Friedrich von Thiersch. Vorgetragen ..... am 28 Nov. 1860, ... von Georg Martin Thomas. 4to pamph. München. 1860.

Grenzen und Grenzgebiete der physiologischen forschung. Festrede ..... gehalten von Dr. C. Harless. 4to pamph. München. 1860.

Denkrede auf Gotthilf Heinrich von Schubert. Gehalten ..... am 26 März, 1861, von Dr. Andreas Wagner. 4to pamph. München. 1861.

Denkrede auf Dr. Georg Thomas von Rudhart. Gelesen ..... am 26 März, 1861, von Karl August Muffat. 4to pamph. München. 1861.

Rede zur Vorfeier des Einhundert und Zweiten Stiftungstages der k. Akademie der Wissenschaften am 26 März, 1861, gehalten von Justus Freiherrn von Liebig. 4to pamph. München. 1861.

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Ueber Brieffteller und Formelbucher in Deutschland während des Mittelalters. Vortrag in der Oeffentlichen Sitzung der k. Akad. der Wiss. am 26 März, 1861, zur Vorfeier ihres 102 Stiftungs-

tages gehalten von Dr. Ludwig Hockinger. 4to pamph. München. 1861.

Ernest Sedlaczek.

Ueber Visir- und Recheninstrumente. 8vo pamph. Wien. 1856.

Kompendium der Ebenen und Sfärischen Trigonometrie. 8vo pamph. Wien. 1856.

Anleitung zum Gebrauche einiger logarithmisch getheilter Rechenschieber (Sliding-Rule, règle-à-calcul) solcher Instrumente mittelst deren man alle mit Logarithmen lösbaren Aufgaben schnell und sicher völlfuhren kann. Nebst Vielen für die Rechnung auf dem Papiere mit Vortheil angewandten Tafeln und Formeln. 2 Auflage. 16mo pamph. Wien. 1856.

Imperial Academy of Sciences, Vienna.

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Almanach der Kais. Akad. der Wissen. XI. Jahr. 16mo. Wien. 1861.

Jahrbücher der K. K. Central Anstalt für Meteorologie und Erdmagnetismus, von Karl Kreil. VII. Band. Jahr. 1855; VIII. Jahr. 1856. 4to. Wien. 1860 – 61.

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Journal of the Society of Arts, and of the Institutions in Union. Vol. IX. Nos. 428 – 458, 467 – 469; Vol. X. Nos. 470 – 480. 8vo. London. 1860 – 62.

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Verhandlungen. Band X. Jahr. 1860. 8vo. Wien. 1860.

Natural History Society of Prussian Rhineland and Westphalia.

Verhandlungen. XVII. Jahr. 8vo. Bonn. 1860.

Linnean Society of Normandy.

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